Electric Load Forecast

2000/01 - 2020/21

Prepared by:
Market Forecast

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EXECUTIVE SUMMARY

This document outlines the assumptions, information sources, and process used to prepare the 2000 forecast, and explains the drivers, factors, and uncertainties influencing future electricity demands. The Electric Load Forecast is one of the key drivers of BC Hydro's planning activities. Updated on an annual basis, the primary purpose of the forecast is to address the key questions of "when, where, why, and how much" electricity will be required within the province to allow BC Hydro to evaluate future investments and planning alternatives. The electric load forecast is the basis for projecting domestic sales and revenues. As such, it also provides key market and customer information for the pursuit of market options and electricity trade decisions.

Economic and Demographic Outlook

Year 2000 started off looking like another one of relatively strong growth for Canada and the U.S. Manufacturing exports to the U.S. were expected to continue to grow to feed the mounting demand of a U.S. economy that has been operating at close to full employment. Commodity prices were also expected to continue to rebound as a result of an expected recovery in Asia from the financial crisis of 1997.

Economic events did unfold more or less as expected until growing inflation from an over-heated U.S. economy became a major concern. Signs of an economic slowdown in the U.S. started to surface when mid-year consecutive interest rate increases started to achieve their desired results. The outlook became rather pessimistic towards the end of the year when corporate profits began to fall and the manufacturing sector started to accumulate inventories. Other factors such as how rising global oil prices may affect Europe and the economic recovery in Asia, growing energy prices in North America, and stock market volatility had also added much uncertainty to the outlook.

It is expected that some slowdown in the U.S. will occur in the near term. Overall the potential of the U.S. economic downturn becoming a recession is considered minimal. The slowdown will likely continue until monetary stimulation starts to take effect in the U.S., residential construction begins to rise, and accumulation of inventories by the U.S. manufacturing sector starts to fall.

After three years of relatively weak economic growth, the BC economy is expecting a modest recovery in 2001 largely due to improved consumer spending. Inter-provincial migration to BC has been negative since 1998. Net gains in total population in BC since 1998 were the result of international migration and population growth within BC. An outlook of positive growth in BC will provide more employment and encourage higher migration to BC from other provinces, providing more demand for housing and markets for domestic consumption.

In the longer term, BC is expected to be one of the strongest growth provinces. BC remains a desirable destination for inter-provincial and international immigration. As a result, BC's population is expected to grow at a rate higher than the national average in the long-term. With more robust economic growth in Asia expected to continue, BC will benefit from an expanding international market for commodity products. Continuing dependence from countries in the Pacific Rim region for Canada's resource based products will enable BC to become Canada's communication and transportation link because of its proximity.

Electricity Demand Outlook

Total annual BC Hydro service area sales to residential, commercial, and industrial customers are projected to increase to 55,161 GW.h by 2010/11, and to 62,643 GW.h by 2020/21, for an average annual growth of 1.7% and 1.5% respectively. The residential sector is responsible for 3,043 GW.h of the increase, the commercial sector is responsible for 3,574 GW.h, and the industrial sector is responsible for 865 GW.h.

Projected increases in electricity sales are mainly due to higher distribution electricity sales. BC's population is expected to continue to increase at a rate above the Canadian average because of assumptions such as an increase in the number of retirees, more international immigrants, and lifestyle related benefits. Increases in population will produce more requirements for housing and a larger consumer market, enabling a greater residential and commercial electricity demand.

Increased electricity consumption will come from growing applications of electro-technologies and from more automation in general. The use of technologies at home and to enhance business productivity and competitiveness is expected to continue. Increasing demands to preserve the natural environment and growing pressures from global competition will require BC's resource-based industries to shift to a greater degree of value-added manufacturing. Value-added products would require the substitution and enrichment of valuable raw materials by other input including energy. Productive gains from computerization were credited to be a major factor enabling the high economic growth, low inflation economic environment to flourish in the 1990s. Automation and computerization would imply the enhancement of labour-intensive input by machinery and computer-based devices, resulting in an increase in energy requirement.

TABLE ES-1

Forecast Sales By Sector

YEAR	RESIDENTIAL		COMMERCIAL		INDUSTRIAL	
	GW.h	Growth Rate	GW.h	Growth Rate	GW.h	Growth Rate
1999/00	14,572		13,177		17,890	
2004/05	15,647	1.4%	15,150	2.8%	18,051	0.2%
2010/11	17,197	1.5%	17,443	2.6%	20,521	1.3%
2020/21	20,240	1.6%	21,017	2.2%	21,386	0.9%

Note: Growth rates shown are the average cumulative annual growth over the next 5, 10, and 20 years.

TABLE ES-2

Probable Load Forecast

YEAR	DOMESTIC SALES		GROSS REQUIREMENTS		INTEGRATED SYSTEM PEAK	
	GW.h	Growth Rate	GW.h	Growth Rate	MW	Growth Rate
1999/00	46,377		51,946		8,646	
2010/11	56,063	1.7%	62,607	1.7%	11,115	2.3%
2020/21	63,690	1.5%	71,165	1.5%	12,913	1.9%

Note: This forecast includes the impacts of savings from Power Smart program. Growth rates shown represent the average cumulative annual growth over the next 10 and 20 years.

Forecast Uncertainty

A sensitivity analysis was conducted to derive an uncertainty band for the forecast. Five major causal factors were analyzed to determine the range of forecasts that would have an 80% confidence level of encompassing the actual demand outcome. The high and low average annual growth rates were projected to be about 2.1% and 1.3% in gross requirements, respectively. By 2010/11, the difference in gross requirements between the Probable and High forecasts is 2,352 GW.h, and 2,413 GW.h between the Probable and Low forecasts.

FIGURE ES-1

Total Gross Requirements

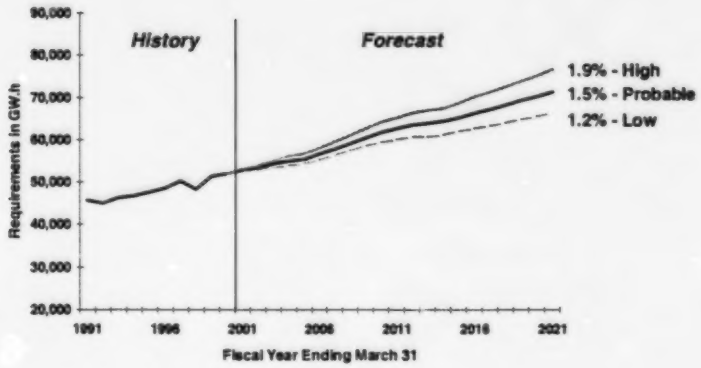
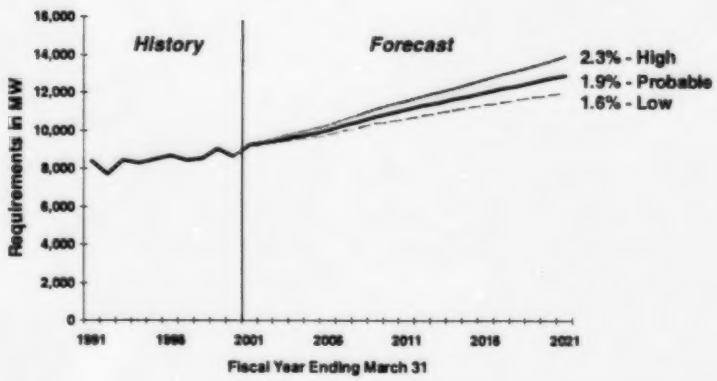


FIGURE ES-2

Peak Demand Forecast



SECTION 1 - INTRODUCTION

BC Hydro Service Area Overview

BC Hydro is the third largest electric utility in Canada, and generates approximately 78% of the electricity consumed in the province of BC. The remainder is generated by industry (primarily forest products and operations) in self-generation facilities; by Alcan at its Kemano plant; by West Kootenay Power and by Cominco in the south-central portion of the province; and by a few small facilities outside BC Hydro's grid.

Ninety-one percent of BC's 4.1 million population resides in BC Hydro's service area. That translates into more than 1.5 million residential, commercial, and industrial customer accounts.

Electricity is provided primarily by BC Hydro's 11,115 MW installed capacity, 90% of which is hydroelectric-based, and delivered to customers over more than 74,650 km of transmission and distribution power lines. In the 1999/00 fiscal year (April 1999 to March 2000), including electricity trade, 69,852 GW.h of electricity were sold, providing revenue of 3,457 million dollars.

Purpose of the Forecast

The advent of industry restructuring has created major challenges for electric utilities. Whereas the forecast of electricity demand remains a key input for supply planning, projection of sales and revenue is also an essential element in many market and business planning related activities. As a result, 2000 has marked a turning point as far as defining BC Hydro's forecasting needs are concerned.

The primary purpose of the 2000 forecast remains to address the key questions of "*when, where, why, and how much*" electricity will be required. Hence, this document outlines the major assumptions, and information sources used to assess total electricity sales to customers currently served by BC Hydro. This report has ten main sections including a Glossary and an Appendix.

The sections are as follows:

Section 1

Introduction

Section 2

Probable Electricity Requirements presents the forecast in summary form for readers not interested in sectoral detail.

Section 3

Economic and Demographic Outlook describes economic and population assumptions used to update the forecast.

Sections 4, 5 and 6

Residential Sales, *Commercial Sales and Industrial Sales*, respectively, contains assumptions used in preparing the sectoral energy forecasts.

Section 7

Regional Peak Forecast explains the regional economic and peak demand forecasts.

In a deregulated and competitive environment, factors influencing market uncertainties and opportunities will have major planning implications. It is very important that the forecast reflect short term changes in the marketplace. Increasingly, the focus of the forecast will be extended to enable marketing support, in addition to provide information on load requirements and revenues to meet the diverging needs of all internal users. The extent to which a utility is able to successfully forecast its market, sales

and profits will provide the foundation for the pursuit of business options, strategies and plans.

Section 8

Forecast Process and Methodology describes the approach used in developing the Probable Forecast, including the iterative process employed in evaluating the impact of the load forecast on Hydro's supply, demand, and financial planning functions.

Section 9

Marketing and Power Smart discusses the present status of BC Hydro's marketing and demand-side management programs and the methods used to incorporate them into the load forecast.

Section 10

Forecast Uncertainty and Sensitivity Analysis explains the analysis of the uncertainty band around the probable energy and peak demand forecasts; discusses the weather sensitivity of peak demands; and describes scenario analyses.

Glossary

A glossary of terms has been included, which defines some of the terminology used in the report.

Appendix

The appendix includes a detailed table of energy forecasts by rate category to 2010/11.

SECTION 2 - PROBABLE ELECTRICITY REQUIREMENTS

1999/00 Sales

Total system sales for the 12 months ending March 2000 were 46,691 GW.h, a 1.9% increase over sales for the preceding fiscal year ending March 1999.

In 1999/00, residential sales increased by 600 GW.h or 4.3% over the previous 12-month period. Residential sales for 1999/00 were 398 GW.h or 2.7% below forecast because of warm weather. The Environment Canada normal value for annual degree days for the BC Hydro service area is 3,349 degree days. In 1999/00, the BCH service area experienced 3,224 degree days which was 3.7% warmer than normal.

Commercial sales increased by 363 GW.h over the 12-month period, and were 1.4% above forecast. The variance in commercial sales has remained small throughout the entire 1999/00 fiscal year mainly due to an anticipated slowdown in the economy. The anticipated slowdown was the result of factors such as poor prices for BC's commodity exports, and weak consumer confidence.

Industrial sales were 187 GW.h lower in 1999/00 compared to sales in 1998/99. Actual industrial sales were 2.2% above forecast mainly as a result of an improvement of the global pulp and paper market. Total global pulp inventories remain low and global pulp prices continue to increase, providing a healthy market for both BC's pulp and paper sector and chemical sector which supply its product mainly to BC's pulp and paper mills.

Sales and Gross Requirements

The probable electricity forecast includes electricity sales in BC Hydro's integrated and non-integrated service areas, plus domestic inter-utility and firm export commitments. Interruptible export sales and Powerex sales are excluded.

Domestic inter-utility commitments include sales forecasts for customers in B.C. presently not served by BC Hydro.

Firm exports include sales under contractual agreements to customers outside B.C.

(a) Total Sales to BC Hydro Service Area

Total annual BC Hydro service area sales to residential, commercial, and industrial customers are projected to increase to 62,643 GW.h by 2020/21, for an average annual growth of 1.5%.

The residential sector is responsible for 5,668 GW.h of the increase, the commercial sector is responsible for 7,840 GW.h, and the industrial sector is responsible for 3,496 GW.h.

(b) Total Domestic Inter-Utility Sales and Firm Export Sales

Domestic inter-utility sales are forecast to increase by 318 GW.h for an average annual growth rate of 1.2% over 20 years.

Firm export sales are forecast to increase at an annual rate of 0.5% over the 20 years.

(c) Total Firm Sales

Total firm sales are projected to increase from 46,691 GW.h in 1999/00 to 64,012 GW.h in 2020/21 for an average annual growth rate of 1.5%.

(d) **Gross Energy and Capacity Requirements**

Total gross generation requirements are projected to increase from 51,946 GW.h in 1999/00 to 71,165 GW.h in 2020/21 for an average annual growth of 1.5%. Figure 2.1, Probable Gross Energy Requirements, summarizes the gross energy forecast by sector for BC Hydro. Table 2-1 on the following page, provides more detail on this forecast.

Integrated system capacity requirements are projected to increase from a system peak of 8,646 MW in 1999/00 to 12,913 MW in 2020/21, for an average annual growth rate of 1.9%. Total system capacity requirements are projected to increase from a system peak of 8,695 MW in 1999/00 to 12,985 MW in 2020/21.

FIGURE 2-1

Probable Gross Energy Requirements

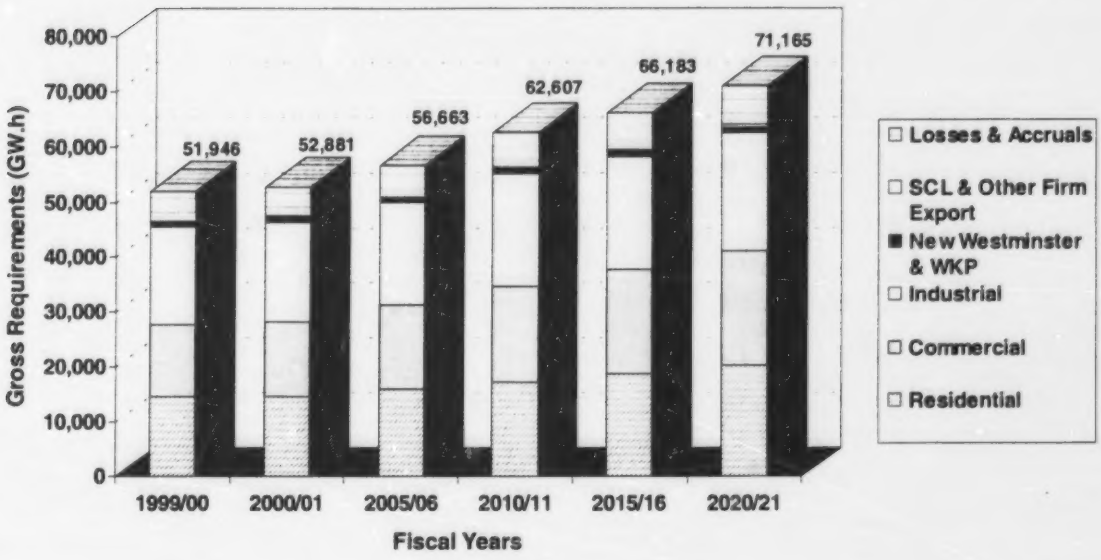


TABLE 2-1

BC HYDRO PROBABLE GROSS LOAD REQUIREMENTS BY MAJOR SECTORS
(Including SCL & WKP)

Fiscal Year	Resi-dential Sales (GW.h)	Comm-ercial Sales (GW.h)	Indus-trial Sales (GW.h)	WKP Sales (GW.h)	SCL Sales (GW.h)	Other Sales (GW.h) (1)	Total Firm Sales (GW.h) (2)	Losses and Accrual (GW.h)	Total Gross Require-ments (GW.h)	Less Non-Integr. (GW.h)	INTEGR. SYSTEM Total Gross Require-ments (GW.h)	Peak (MW)
Actual												
1995/96	13,300	11,919	17,630	77	284	379	43,590	5,028	48,618	218	48,400	8,688
1996/97	13,983	12,168	17,447	66	319	379	44,362	5,923	50,285	256	50,030	8,455
1997/98	13,802	12,466	16,339	95	312	370	43,384	4,958	48,342	247	48,095	8,567
1998/99	13,972	12,814	18,077	272	289	381	45,805	5,505	51,310	248	51,061	9,027
1999/00	14,572	13,177	17,890	366	311	375	46,691	5,255	51,946	255	51,691	8,646
Forecast												
2000/01	14,694	13,538	18,145	587	318	379	47,661	5,221	52,882	260	52,622	9,238
2001/02	14,932	13,943	18,036	591	316	383	48,201	5,293	53,494	265	53,229	9,385
2002/03	15,172	14,334	18,252	449	316	387	48,910	5,379	54,289	268	54,021	9,546
2003/04	15,417	14,740	18,218	420	316	391	49,502	5,455	54,957	272	54,685	9,698
2004/05	15,647	15,150	18,051	400	318	395	49,961	5,522	55,483	276	55,207	9,843
2005/06	15,900	15,549	18,446	416	316	399	51,026	5,638	56,664	279	56,385	10,031
2006/07	16,145	15,925	18,910	449	316	403	52,148	5,758	57,906	283	57,623	10,280
2007/08	16,399	16,309	19,421	458	316	407	53,310	5,883	59,193	286	58,907	10,458
2008/09	16,655	16,680	19,942	467	318	411	54,473	6,007	60,480	290	60,190	10,726
2009/10	16,923	17,052	20,354	476	316	415	55,536	6,125	61,661	294	61,367	10,918
2010/11	17,197	17,443	20,521	486	316	420	56,383	6,224	62,607	298	62,309	11,115
Avg. Annual % Incr. 11 years: 99/00-10/11	1.5%	2.6%	1.3%	2.6%	0.1%	1.0%	1.7%	1.6%	1.7%	1.4%	1.7%	2.3%
2011/12	17,442	17,713	20,662	495	316	424	57,052	6,301	63,353	302	63,051	11,284
2012/13	17,721	18,075	20,361	505	318	428	57,409	6,361	63,770	306	63,464	11,457
2013/14	18,008	18,451	20,065	515	316	432	57,787	6,423	64,210	311	63,900	11,640
2014/15	18,319	18,822	20,246	526	316	436	58,664	6,526	65,190	315	64,875	11,816
2015/16	18,636	19,188	20,437	536	316	440	59,553	6,630	66,183	319	65,864	12,005
2016/17	18,959	19,549	20,627	547	318	444	60,443	6,735	67,178	324	66,854	12,185
2017/18	19,281	19,910	20,816	558	316	448	61,328	6,839	68,167	328	67,839	12,361
2018/19	19,604	20,273	21,003	569	316	452	62,217	6,943	69,160	332	68,828	12,547
2019/20	19,921	20,636	21,192	580	316	456	63,101	7,046	70,147	336	69,811	12,731
2020/21	20,240	21,017	21,386	592	318	460	64,012	7,153	71,165	341	70,825	12,913
Avg. Annual % Incr. 10 years: 10/11-20/21	1.6%	1.9%	0.4%	2.0%	0.1%	0.9%	1.3%	1.4%	1.3%	1.4%	1.3%	1.5%
Avg. Annual % Incr. 21 years: 99/00-20/21	1.6%	2.2%	0.9%	2.3%	0.1%	1.0%	1.5%	1.5%	1.5%	1.4%	1.5%	1.9%

Notes:

1. Inter-Utility transfers (excluding WKP) and firm export (excluding SCL).
2. Interruptible Marketing (E+) and Demand Side Management (DSM) programs included in Actuals and in Forecast numbers.

SECTION 3 - ECONOMIC AND DEMOGRAPHIC OUTLOOK

Year 2000 started off looking like another one of relatively strong growth for Canada and the U.S. because of favorable factors such as 2000 being an election year in the U.S., bullish outlook on domestic consumption, stock market gains etc. Manufacturing exports to the U.S. were expected to continue to grow to feed the mounting demand of a U.S. economy that has been operating at close to full employment. After struggling with low global demand since the financial crisis of 1997, commodity prices were also expected to continue to rebound as a result of an anticipated recovery in Asia; providing a wider market for regions that depend on commodity exports such as BC.

Economic events did unfold more or less as expected until growing inflation from an over-heated U.S. economy became a major concern. Decisive measures were employed by the U.S. Federal Reserve to cool economic expansion in the U.S. Signs of an economic slowdown in the U.S. started to surface when mid-year consecutive interest rate increases started to achieve their desired results. The outlook became rather pessimistic towards the end of the year when corporate profits began to fall, and the manufacturing sector started to accumulate inventories. Other factors such as how rising global oil prices may affect Europe and the economic recovery in Asia, growing energy prices in North America, and stock market volatility also added much uncertainty to the outlook. Prices for commodities were lower compared to the beginning of the year, resulting in some downtime among BC's forest product exporters.

Short Term

The U.S. is the largest trading partner of Canada. Therefore, the performance of the Canadian economy in 2001 will continue to depend, to a large extent, on economic events unfolding in the U.S. Economic indicators in the U.S. have been suggesting a slowdown in the economy since mid-year 2000. Although the U.S. Federal Reserve is expected to adopt more relaxed monetary measures when sure signs of an economic downturn are confirmed, it is expected that some slowdown in the U.S. will occur in the near term. The American President-elect campaigned to lower taxes. These yet unknown fiscal policies that may be employed by the new U.S. administration will have a definitive consequence on the economic outlook over the next few years.

Overall the potential of the U.S. economic downturn becoming a recession is considered minimal. The slowdown will likely continue until monetary stimulation starts to take effect in the U.S., residential construction begins to rise, and accumulation of inventories by the U.S. manufacturing sector starts to fall. After nine years of continuous expansion, a slowdown may in fact return the U.S. economy to a more sustainable pace, creating an environment for more moderate growth over the next few years. Canada would benefit from stable growth in the North American economy as a result.

After three years of relatively weak economic growth, the BC economy is expecting a modest recovery in 2001 largely due to improved consumer spending. A slow but steady economic recovery in Asia is also expected to provide an increasing demand for BC's commodity exports. However, these gains can potentially be offset by a prolonged slowdown in the U.S. economy because of reasons such as low demand for lumber for housing, newsprint for advertising, etc. The BC economic forecast for 2001 will depend on the outlook of housing starts, and economic performance in the U.S. to a large extent. Japan is BC's second largest trading partner after the U.S. The Japanese

government is continuing its effort to stimulate the Japanese economy. Steady improvements in the Japanese market will further enhance BC's commodity exporters. Inter-provincial migration to BC has been negative since 1998. Net gains in total population in BC since 1998 were the result of international migration and population growth within BC. An outlook of positive growth in BC will provide more employment and encourage higher migration to BC from other provinces, providing more demand for housing and markets for domestic consumption.

Generally, BC's economy through 2003 is forecast to grow at an annual average rate of 2.6% while BC's population is expected to grow from 4.023 million in 1999 to 4.243 million by 2003, at an average annual growth rate of 1.3%. Lumber prices are expected to improve in 2001 compared to 2000 when interest rates in the U.S. begin to fall and housing starts start to increase. Rise in prices for newsprint and other commodities such as copper are expected to stall until a recovery from the economic slowdown becomes more evident in the U.S.

Long Term

In the longer term, BC is expected to be one of the strongest growth provinces. BC remains a desirable destination for inter-provincial and international immigration. As a result, BC's population is expected to grow at a rate higher than the national average in the long-term. With more robust economic growth in Asia expected to continue, BC will benefit from an expanding international market for commodity products. Continuing dependence from countries in the Pacific Rim region for Canada's resource based products will enable BC to become Canada's communication and transportation link because of its proximity.

BC's population is expected to continue to increase at a rate above the Canadian average because of assumptions such as an increase in the number of retirees, more international immigrants, and lifestyle related benefits. BC's warmer climate has traditionally been very attractive to retirees and to people from other Canadian provinces and for international immigrants. BC's diverse ethnic population is projected to further enhance the province's position as the preferred destination of new immigrants. Desire for outdoor activity and the natural environment also means that younger Canadians, given an equal job opportunity, will prefer to settle in BC for lifestyle reasons.

Economic growth and improved literacy are expected to generate a much larger relative growth in the demand for resource-based products in many developing economies. BC is well positioned to benefit from these emerging opportunities in the longer term because of its proximity to the markets, and the Asian market in particular.

SECTION 4 - RESIDENTIAL SALES

General

Residential sales are forecast to grow from 14,572 GW.h in 1999/00 to 15,647 GW.h in 2004/05, to 17,197 GW.h in 2010/11, and to 20,240 GW.h in 2020/21. These increases represent average annual growth rates of 1.4% over the next 5 years (1999/00 to 2004/05), 1.5% over the next 10 years (1999/00 to 2010/11), and 1.6% over the next 20 years (1999/00 to 2020/21).

The average annual growth rates in this forecast are lower than in previous forecasts. This is mainly due to the fact that this forecast assumes warmer weather based on a rolling 10-year normal, while previous forecasts were based on a fixed 30-year normal (1961-1990) provided by Environment Canada.

The two main drivers of the residential forecast are the forecast of number of residential accounts, and the forecast of use rate (annual electricity consumption per residential account).

Over the ten-year period between 1989/90 and 1990/00, the average annual increase in weather normalized residential sales was 2.7%. Future population growth in B.C. is projected to be lower than it was in the past due to lower economic growth. In addition, the use rate is not expected to continue growing as fast as it did in the past. Therefore, growth in residential electricity sales in projected to be lower than before.

Number Of Accounts

In the short term, the number of residential accounts is based on input provided by BC Hydro's regional staff and from regional economic forecasts. Over the next five years, the number of residential accounts is projected to grow at an average annual rate of 1.27%. This compares with the population growth forecast of 1.34% provided by the Ministry of Finance and Corporate Relations.

In the long term, the number of residential accounts is derived from the population forecast provided by the Ministry of Finance and Corporate Relations. The population in the BC Hydro service area is projected to grow from 3.67 million in 2000 to 4.22 million in 2010, and to 4.82 million by 2020. These increases represent average annual growth rates of 1.40% over the next ten years, and 1.37% over the next twenty years. The corresponding growth rates for the number of residential accounts are 1.38% and 1.37%, respectively.

Use Rate

The use rate forecast is based on projections of factors such as housing mix (single family, row house, apartment, etc.,), heating fuel choices (electric versus non-electric), appliance penetration rates, appliance lifespans and changes in electricity demands.

Currently, 20% of residential accounts are heated electrically, and on average they require 14,430 kW.h per year. Unless regulations or legislation are introduced, this share will likely increase, although the average usage may not change much.

Ten years ago, weather normalized use rate was 10,150 kW.h per year, and increasing by about 150 kW.h per year. Since then, growth in the use rate has been declining, with use rate currently remaining almost constant at 10,470 kW.h per year. Improvements in building insulation and appliance efficiency are the main reasons for the lack of growth in the annual residential use rate.

Over the longer term, use rate is not expected to change much because of the offsetting effects of the following residential trends:

- Space Heating: increased electric market share versus smaller housing units.

  Due to limited availability of land for residential development, the trend in major metropolitan centres is expected to be towards denser housing. Since row houses and apartments are more likely to be built with electric heat than single family homes, the market share for electrically heated housing is expected to increase.

  Although new row houses and apartments tend to be larger than existing similar dwellings, they are generally smaller in size than single family homes, and therefore have lower space heating load requirements.

  The increase in market share of electric space heating is also offset to some extent by improvements in building standards, and by the construction of the Vancouver Island gas pipeline which has made gas space heat available to Island residents.

  However, natural gas prices are projected to be higher for Vancouver Island compared to the Mainland over the entire forecast period. As a result, the growth in the penetration rate of gas heating is anticipated to be slower for Vancouver Island than it is for the Lower Mainland.

- More efficient appliances versus higher penetration.

  Manufacturers throughout Canada and the United States are expected to continue to improve the energy efficiency of major electrical appliances. As older models wear out and are replaced by newer ones, electricity consumption for major appliances such as refrigerators, freezers, ovens, and ranges is forecast to decrease.

  However, new models of these major appliances tend to be larger than models currently in use. Some of the reduction in electricity use resulting from improvements in electricity efficiency will be offset by an increase in appliance size.

- A projected decrease in the number of people per household would tend to reduce electricity use per account.

  However, this reduction is expected to be offset by an increase in the penetration level of small appliances.

  An increase in electricity use is also projected from lifestyle changes and technological improvements. The latter are expected to cause an increase in demand for electronic, entertainment and telecommunication devices in the home. A trend towards home offices is also expected to increase residential electricity consumption in the long term.

  In the long term, the expected overall impact of these various trends is that the factors working to increase the use rate will be offset by the factors working to decrease it, leading to the use rate leveling off.

Residential Sales Forecast

To develop the residential sales forecast for the entire BC Hydro service area, the total service area was divided into four customer service regions, and a forecast was prepared for each region. These regions are: Lower Mainland; Northern Region; South Interior; and Vancouver Island.

For each region, a housing stock forecast was prepared based on the regional number of residential accounts forecast, and on other regional factors such as trends in housing mix and gas availability.

A use rate forecast was also developed for each region based on projections of penetration rates and individual consumption levels by end use (space heating, water heating, major appliances, and small lifestyle appliances).

The residential sales forecast for a region is the sum of the requirements for each end use. The requirements for each end use are the product of the number of accounts having that end use and the energy used by an average account having that end use.

FIGURE 4-1

Residential Use Breakdown

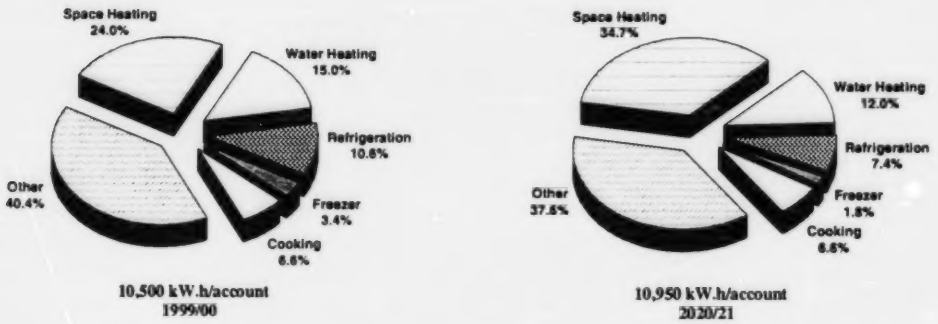


FIGURE 4-2

Residential Trends

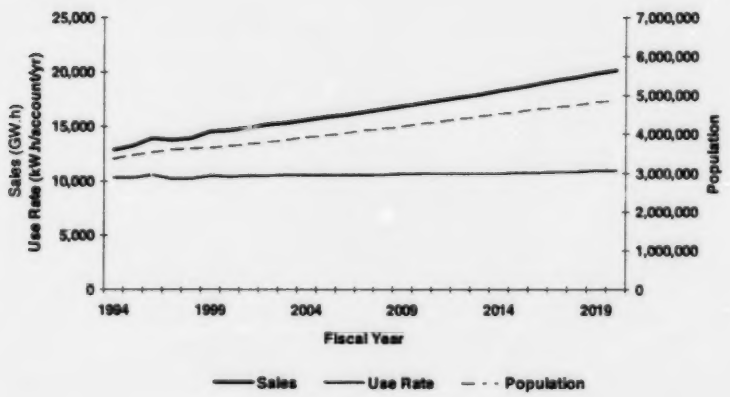


TABLE 4-1

RESIDENTIAL ELECTRIC SALES FORECAST
By Region

Fiscal Year	Lower Mainland (GW.h)	Northern Region (GW.h)	South Interior (GW.h)	Vancouver Island (GW.h)	Total Sales (GW.h)
Actual					
1995/96	6,793	1,378	1,492	3,637	13,300
1996/97	7,158	1,427	1,553	3,845	13,983
1997/98	7,187	1,378	1,518	3,719	13,803
1998/99	7,355	1,357	1,541	3,718	13,973
1999/00	7,670	1,409	1,583	3,909	14,571
Forecast					
2000/01	7,768	1,426	1,630	3,869	14,693
2001/02	7,926	1,443	1,659	3,904	14,932
2002/03	8,089	1,458	1,688	3,937	15,172
2003/04	8,255	1,474	1,717	3,971	15,417
2004/05	8,390	1,493	1,745	4,019	15,647
2005/06	8,533	1,515	1,777	4,076	15,901
2006/07	8,666	1,536	1,808	4,135	16,145
2007/08	8,806	1,558	1,840	4,196	16,400
2008/09	8,946	1,580	1,872	4,257	16,655
2009/10	9,094	1,603	1,905	4,322	16,924
2010/11	9,245	1,626	1,939	4,387	17,197
Average Annual % incr. 11 years: 99/00-10/11	1.7%	1.3%	1.9%	1.1%	1.5%

SECTION 5 - COMMERCIAL SALES

General

Commercial sales are projected to increase from 13,177 GW.h in 1999/00 to 15,150 GW.h in 2004/05, to 17,443 GW.h in 2010/11, and to 21,017 GW.h by 2020/21. Average annual growth rates are 2.8%, 2.6%, and 2.2%, respectively for the three periods.

Sales to the commercial sector are projected to grow faster than sales to the industrial sector over the next 20 years as a result of the continuing trend in B.C. towards a more service-based economy. In 1999/00, commercial sales accounted for 28.4% of BC Hydro's domestic sales, compared with 28.2% in 1998/99. The gain in share in 1999/00 is the result of a major strike by a key industrial account. After adjusting for the strike however, share of commercial sales fall to 28.1%. This share is forecast to increase to about 33.0% by 2020/21.

The commercial sector consists of five major subsectors:

- Transportation, Communications and Other Utilities (TCU)
- Wholesale and Retail Trade (Trade)
- Finance, Insurance and Real Estate (FIRE)
- Community, Business and Personal Services (Services)
- Public Administration (Government)

Any customers not included in these subsectors are grouped into one subsector called "Unclassified".

As outlined in the table below, the largest consumer by subsector is the Services subsector, followed by the Trade, Financial, and Transportation subsectors.

Contribution to Commercial Sale by Subsector

Subsector	1999/00 Sales (GW.h)	Percent Share
Services	4,895	37.2%
Trade	2,749	20.9%
Financial	2,663	20.2%
Transportation	1,822	13.8%
Government	851	6.5%
Unclassified	195	1.4%

Major Assumptions and Projected Trends

The amount of floor stock in each of the subsectors is a key determinant of commercial electricity sales. Population and GDP forecasts are used as proxies to drive the growth in floorspace estimates, and when combined with the projected electricity use rate per unit floorspace (kW.h/m^2), provide an estimate of the electricity requirements of the commercial sector.

The major assumptions of the commercial forecast are:

- Commercial floorspace is estimated to grow at an average annual growth rate of 1.6% between 1999/00 and 2020/21. This compares to a historical five-year (1994/95 to 1999/00) growth of 1.7% per year.

- Average intensity (electricity use rate per unit floor space) is forecast to continue to grow at 0.6% per year between 1999/00 and 2020/21. This compares to a 0.7% growth per year between 1994/95 and 1999/00.

Total commercial sales for the fiscal year ending March 2000 were 363 GW.h higher compared to the previous fiscal year ending March 1999. This increase in sales is above forecast for the year. The higher than expected growth in the commercial sales is due to BC's improved economic condition. The provincial economy grew by 1% in 1999 compared to a negative growth of 0.5% in 1998. The increase is also partly due to the switch from SIC (Standard Industrial Classification) to NAIC (North American Industry Classification) code. Compared with sales to the end of the previous fiscal year ending March 1999, sales to the Finance, Insurance and Real Estate subsectors; the Community Business and Personal Services subsectors; the Government subsector were increased by 9 GW.h 340 GW.h and 46 GW.h respectively. While sales to the Transportation subsector; Wholesale and Retail trade subsectors were decreased by 4 GW.h and 49 GW.h respectively. Sales to the "Unclassified" subsector were 20 GW.h higher compared with the previous year.

A higher average annual growth rate is forecast for the first five years of the 20 year period because more commercial activities are expected to be required to support the increasing provincial population. Overall growth in the services sector is expected to continue as the economy continues to strengthen and consumer spending continues to improve. Improving economic conditions will generate more sales to the Service subsector, with the average annual growth rate projected at 2.6% between 1999 and 2004.

In the long term, commercial electricity sales are forecast to continue to grow primarily because of increases in electricity intensity, which in turn are the result of increased use of electronic and information technology. Other factors that are expected to increase commercial sector sales are:

- growth in tourism;
- increased leisure activities;
- new electricity-using technologies becoming more common in commercial establishments;
- increased health care services for an aging population;
- continued growth of Vancouver as an international finance centre; and
- B.C's continued role as Canada's link with the fast-growing far east markets.

Compared to the 1998 commercial sales forecasts, sales are projected to grow at about the same rate mainly due to moderate growth in floor space.

Subsectors

(a) Transportation Communication and Other Utilities

The share of commercial sales to this subsector, which is comprised mainly of transportation, grain elevators, radio and television broadcasting, water and telephone systems, has risen in the past year due to increased purchases by BC's three grain terminals because of changes in grain shipping arrangements around the country. Increases in sales to new natural gas processing plants are expected because of increased production and delivery of gas to lucrative markets in Canada and the US. Construction of gas gathering, cleaning, transmission and distribution facilities are growing because higher prices are available to producers to get their product to US markets. The completion of the new terminal building at the Vancouver International Airport, development of a new light rail transit

(LRT) system in the Broadway corridor and the subsequent extension of Skytrain to other Lower Mainland suburban areas is expected to increase sales to this sector.

Sales to this subsector are forecast to increase at an average growth rate of 1.6% from 1,822 GW.h or 13.8% of total commercial sales, in 1999/00 to 2,516 GW.h, or 12.0% of total commercial sales, in 2019/20. Factors contributing to growth in this subsector are: the further expansion of the International Terminal building at the Vancouver International Airport where new gates will be added; improvements to port facilities; the construction of the grain and container terminals at the Vancouver Port Corporation's Roberts Bank facilities. These new facilities are projected to result in additional annual sales of 60 GW.h starting in 2000/01, increasing to 90 GW.h or 2.2% of subsector demand by 2020/21.

(b) **Wholesale and Retail Trade**

At the end of March 2000, there were about 6,670 wholesale trade, over 24,000 non-food retail trade, and about 4,100 food retail (groceries) trade customers in the BC Hydro service area.

Total sales to the Wholesale and Retail Trade subsector decreased slightly from 2,798 GW.h in 1998/99 to 2,749 GW.h in 1999/00. The slight decrease in Electricity Sales to this subsector is due to factors such as high unemployment, weak consumer confidence, and small personal income growth.

In the long term, this subsector is projected to increase its share of total commercial electricity sales because more trade activities will be generated to support both a growing population and increased tourism. Also, consumer spending has improved due to low inflation rate and interest rate, resulting in more wholesale and retail activities and commercial construction.

Sales to this subsector are forecast to increase at an average annual growth rate of 2.4% from 2,749 GW.h, or 20.9% of total commercial sales, in 1999/00 to 4,554 GW.h, or 21.7% of total commercial sales, in 2020/21.

(c) **Finance, Insurance and Real Estate**

Office buildings account for approximately 65% of electricity sales to this subsector. Electricity sales to this subsector have grown steadily for the past five years despite continued energy efficiency improvements in office buildings. The full impact of improved efficiency appears to be offset to some degree by continued increases in the use of office automation and information technology, and because of steady growth in the number of commercial office buildings. It is projected, however, that the electricity use of this subsector will decline slightly over time, particularly in the office buildings component.

Office vacancy rates are rising in some cities and holding steady in others. Downtown Vancouver had little change, and at the end of 1998 the commercial vacancy rate stood at 7.4%. Looking ahead to 2001 and 2002, the vacancy rate is expected to remain at the 1999 level. The long term outlook is for more expansion in office space as office vacancy rates in the city remain low.

Sales to this subsector are forecast to increase at an average annual growth rate of 2.6% from 2,663 GW.h, or 20.2% of total commercial sales, in 1999/00 to 4,602 GW.h, or 21.9% of total commercial sales, in 2020/21.

(d) **Community Business and Personal Services**

The service subsector is a very diverse group, consisting of establishments such as schools, hospitals, hotels, restaurants, and other personal services such as barber and beauty shops and religious organizations.

In the short term, the growing population will create a demand for more service sector establishments. Over the long term, the demand on health components of the service subsector will continue to grow as the population ages. The food service, amusement and recreation and accommodation components are projected to continue to expand as well, as tourism is expected to play an increasingly important role in the BC economy.

The provincial government spending cutbacks have diminished school and institutional construction in all regions of the province. As a result of the spending freeze, involvement of the private sector is being explored, however the trend is still slow but expected to accelerate. At present, private sector activity is limited to unique projects such as the expanded convention facility in Vancouver. Expansion of the Vancouver convention centre is expected to begin next year. The centre will include additional meeting and show space plus new hotel facilities, an upgraded Seabus terminal and more commercial space.

Sales to this subsector are forecast to increase at an average annual growth rate of 2.1% from 4,895 GW.h, or 37.1% of total commercial sales, in 1999/00 to 7,643 GW.h, or 36.4% of total commercial sales, in 2020/21.

(e) **Public Administration**

The entire range of government services, from federal institutions such as correctional services to foreign government agencies, are included in this subsector.

This subsector is forecast to have the second slowest growth of the five commercial subsectors after the unclassified.

Although, considerable success is being achieved now in meeting the government's annual deficit targets, this subsector's share of total commercial sales will continue to decline as governments at all levels strive to reduce their budget further by controlling spending and restricting expansion. As governments reduce expenditures, involvement of the private sector is being explored. This trend is still slow, but expected to accelerate.

Sales to this subsector are forecast to increase at an average annual growth of 2.6% from 851 GW.h, or 6.5% of total commercial sales, in 1999/00 to 1,459 GW.h, or 6.9% of total commercial sales, in 2020/21.

(f) **Unclassified**

The Unclassified subsector consists primarily of commercial establishments that have not been SIC (Standard Industrial Classification) coded, or that do not belong to any of the five major subsectors. There were about 6,900 customers in this group at the end of 1999/00 fiscal year.

Sales to the unclassified subsector increased in the past year as a result of higher than expected non-classification of new commercial accounts. It is anticipated however, that most of these accounts will be SIC coded before the changeover to the NAICS system at BC Hydro in the fall of 1999.

Sales to this subsector are forecast to increase at an average annual growth rate of 0.9% from 195 GW.h, or 1.5% of total commercial sales, in 1999/00 to 236 GW.h, or 1.1% of total commercial sales, in 2020/21.

Figure 5.1 summarizes the commercial sales forecast by sector and Table 5-1 details the commercial sales forecast by sector over the forecast period.

FIGURE 5-1

Commercial Sales Forecast

By Major Sector

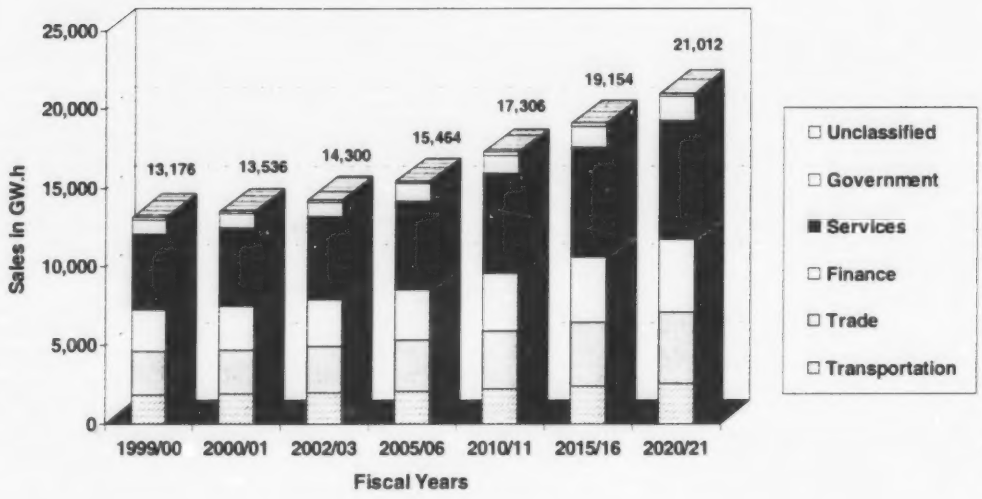


TABLE 5-1
Commercial Electric Sales Forecast
By North American Industry Classification System (NAICS) and Rate

Fiscal Year	Distribution Rate Customers							
	Transportation, Communications & Other Utilities (GW.h)	Wholesale & Retail Trade (GW.h)	Finance Insurance & Real Estate (GW.h)	Community, Business & Pers. Serv. (GW.h)	Public Admin. & Defence (GW.h)	Unclassified (GW.h)	Transmission (GW.h)	Total Sales (GW.h)
Actual								
1995/96	1,397	2,613	2,525	3,945	690	169	580	11,919
1996/97	1,421	2,634	2,561	4,037	700	184	632	12,168
1997/98	1,441	2,697	2,613	4,142	724	175	674	12,466
1998/99	1,512	2,795	2,654	4,291	751	175	637	12,814
1999/00	1,518	2,892	2,663	4,479	794	195	635	13,176
Forecast								
2000/01	1,572	2,833	2,751	4,769	816	178	619	13,538
2001/02	1,593	2,923	2,842	4,930	844	181	630	13,943
2002/03	1,624	3,013	2,927	5,070	869	186	645	14,334
2003/04	1,658	3,098	3,028	5,198	899	191	668	14,740
2004/05	1,686	3,185	3,123	5,340	926	195	695	15,150
2005/06	1,712	3,273	3,216	5,477	952	199	720	15,549
2006/07	1,742	3,360	3,311	5,610	980	202	720	15,925
2007/08	1,770	3,450	3,408	5,748	1,007	206	720	16,309
2008/09	1,795	3,539	3,499	5,883	1,003	210	720	16,679
2009/10	1,823	3,625	3,593	6,016	1,061	214	720	17,052
2010/11	1,851	3,717	3,689	6,157	1,088	216	724	17,442
Average Annual % Incr. 11 years: 99/00-10/11	1.8%	2.3%	3.0%	2.9%	2.9%	0.9%	1.2%	2.6%

SECTION 6 - INDUSTRIAL SALES

General

Total sales to the industrial sector decreased by 1.0% over the past fiscal year, from 18,077 GW.h in 1998/99 to 17,890 GW.h in 1999/00. After struggling with slow growth and threats of a global financial crisis, the global economy has demonstrated some strength since 1999, providing some much needed stability and demand for BC's commodity exports. International commodity prices continued to increase through the first half of 2000 as a result.

The global pulp and paper market continued to improve through the first half of 2000 due to low total global pulp inventories. Rising pulp prices have provided a healthy market for both BC's pulp and paper sector and chemical sector that supplies its product mainly to BC's pulp and paper mills. Despite the Countervail Agreement restricting more exports of wood products to the U.S., BC is able to benefit from high housing starts in the U.S. because of a booming economy. Rise in lumber exports was finally cut short by a decline in residential construction in the U.S. because of increases in interest rates. Lumber prices were much lower in the second half of 2000 as a result. Strengthening copper markets have enabled BC's copper mines to continue to produce at a high operating rate through 2000. Coal production in the first half of 2000 has increased over production in the same period of 1999 due to a slow but steady economic recovery in Asia. However, the continuing weakness in world coal market has resulted in the closure of a number of mines including Quintette.

Figure 6.1 summarizes the sales to BCH's major industrial customers.

Short Term

There is a direct and tangible link between the global economy and BC's resource-based exports. Some production cutback by BC's pulp and paper producers is expected as long as the slowdown in the U.S. economy continues. As a result of high operating rates but slow shipments, pulp inventories have been on an increase, creating a downward pressure on global pulp prices since mid-year in 2000. This trend is expected to continue at least in the short-term. Shipments of newsprint are also expected to remain depressed until signs of a recovery from the slowdown in the U.S. become evident. Copper is the most valuable metal mined in BC and is sold almost exclusively into offshore markets. As such, BC's mines are strongly influenced by external market factors. The fundamental reason for the improvement in copper prices in 2000 is largely because of increases in demand and closures of some less-productive mines around the world when copper prices were depressed. Increases in copper price will result in higher production in regions such as Latin America and Asia. In addition to their low costs, mines in these regions are new and more productive because of improvements in mining techniques. These production increases are expected to have a moderating effect on further short-term copper price increases although BC's copper mines are expected to continue to operate at a high rate. BC's coal mining sector will continue to confront a decline in coal prices as a result of worldwide decreases in demand for steel and steel products. Although it is not expected to occur in the short-term, a major economic turnaround will bring up the world coal market. BC's coal mines produce mainly metallurgical coal. Economic growth will be followed by increased development in infrastructure and the demand for steel, and therefore more demand for metallurgical coal for steel

production. Recent increases in global oil prices and natural gas prices in North America have renewed interest in using coal as a fuel substitution. However, no new mine development is expected as BC is low in thermal coal reserve.

Long Term

Projected increases in industrial electricity use are the result of a number of factors including changing product mixes, the addition of more value-added production, and more automation in general. Increasing demands to preserve the natural environment and growing pressures from global competition will require BC's resource-based industries to shift to a greater degree of value-added manufacturing, as well as to utilize new technologies and previously untapped resources. Value-added products would by definition require the substitution and enrichment of valuable raw materials by other input including energy, resulting in an increase in energy requirement. Productive gains from computerization were credited with being a major factor enabling the high economic growth, low inflation economic environment to flourish in the 1990s. There is a lack of hard information on the amount of electricity actually being consumed by millions of computers and computer-based devices in industries. As increasingly more production is being computerized, the distinction between various automated and computerized controls and processes is becoming less clear. However, automation and computerization would imply the enhancement of labor-intensive input by machinery and computer-based devices, resulting in an increase in energy requirement.

While BC's non-resource based economy is becoming increasingly more important, the extraction and processing of primary resources is expected to remain a significant business activity in BC. Moderate growth in BC's industrial sector is expected to occur with changes at the policy level and more investment in capital projects.

Industrial sales are projected to increase from 1999/00 levels of 17,890 GW.h to 18,051 GW.h by 2004/05; to 20,521 GW.h by 2010/11; and to 21,386 GW.h by 2020/21. These increases represent average annual growth rates of 0.2% (1999/00-2004/05); 1.3%(1999/00-2010/11); and 0.9% (1999/00-2020/21).

In 1999/00, BC Hydro sold 14,697 GW.h of electricity to its large industrial (transmission) customers, a decrease of 1.3% over the 14,894 GW.h sold in 1998/99. Sales to industrial transmission voltage customers are forecast to increase to 14,730 GW.h by 2004/05; and to 16,842 GW.h by 2010/11; and to 17,130 GW.h by 2020/21. These increases represent average annual growth rates of 0.0% (1999/00-2004/05); 1.2% (1999/00-2010/11); 0.7% (1999/00-2020/21). The remainder of industrial sector sales will be to the numerous, smaller industrial customers on distribution voltages service.

The five major industrial subsectors are:

- Paper and allied products
- Wood manufacturing
- Chemicals and chemical manufacturing
- Metal mining
- Coal mining

In 1999/00, sales to the customers in these five major subsectors comprised 91% of transmission rate sales, and 75% of total industrial sales. Sales to remaining industrial transmission rate customers are combined under "Remaining Transmission Rates". Sales to other miscellaneous industrial customers are combined under "Industrial Distribution Sales".

FIGURE 6-1

1999/00 Sales to BC Hydro Industrial Customers

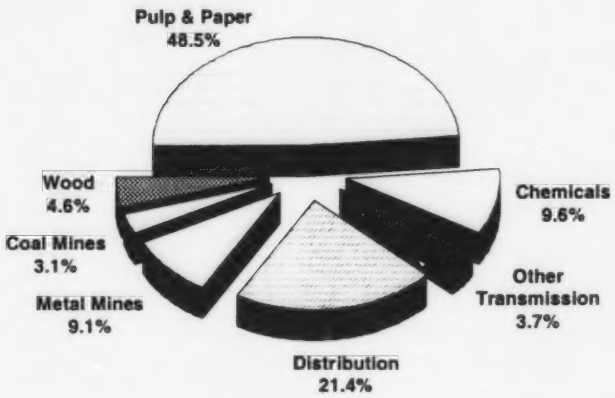


FIGURE 6-2

Industrial Sales Forecast by Major Sector

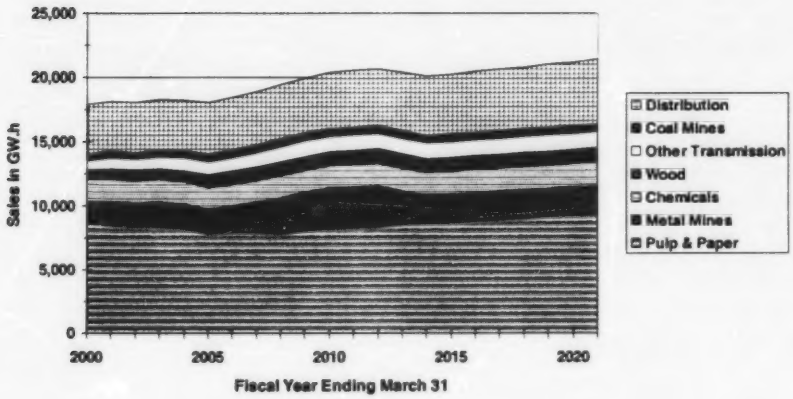


TABLE 6-1

INDUSTRIAL ELECTRIC SALES FORECAST

By North American Industry Classification System (NAICS) and Rate

Fiscal Year	Transmission Rate Customers						Distribution Rate (GW.h)	Total Sales (GW.h)
	Metal Mines (GW.h)	Coal Mines (GW.h)	Wood Mftg (GW.h)	Paper and Allied (GW.h)	Chemical & Chem Products (GW.h)	Remaining Transmission Rate (GW.h)		
Actual								
1995/96	2,182	636	641	8,580	1,260	756	3,576	17,631
1996/97	1,647	658	707	8,365	1,578	758	3,736	17,447
1997/98	1,602	662	769	7,076	1,694	750	3,786	16,339
1998/99	2,006	574	765	8,501	1,685	727	3,820	18,077
1999/00	1,620	558	826	8,685	1,710	663	3,828	17,890
Forecast								
2000/01	1,873	513	844	8,473	1,722	861	3,860	18,146
2001/02	1,918	501	836	8,353	1,721	838	3,870	18,037
2002/03	1,958	546	839	8,340	1,716	950	3,904	18,253
2003/04	1,958	559	842	8,211	1,696	1,006	3,947	18,219
2004/05	1,958	587	1,045	7,775	1,636	1,036	4,015	18,052
2005/06	2,105	591	1,097	7,865	1,656	1,061	4,072	18,447
2006/07	2,418	604	1,108	7,880	1,676	1,091	4,134	18,911
2007/08	2,818	614	1,113	7,820	1,676	1,181	4,199	19,421
2008/09	2,998	611	1,113	8,060	1,696	1,191	4,274	19,943
2009/10	3,198	611	1,113	8,195	1,696	1,191	4,351	20,355
2010/11	3,198	609	1,115	8,293	1,704	1,198	4,404	20,521
Average Annual % Incr. 11 years:								
99/00-10/11	6.4%	0.8%	2.8%	-0.4%	0.0%	5.5%	1.3%	1.3%

SECTION 7 - REGIONAL PEAK FORECAST

Regional peak forecasts are an outlook of the peak demand for electricity for each of the four BC Hydro planning regions (i.e. Lower Mainland, Vancouver Island, South Interior, and Northern Region). These forecasts are typically generated for a 20 year period and are used to support transmission and distribution planning requirements. Aggregating the regional peak forecasts produces the total integrated system peak forecast, used for generation planning purposes.

This section describes the process of generating regional peak forecasts and their aggregation to form an integrated system peak. It includes an explanation of the methodology used to generate the forecast, a discussion of the regional economic outlook and trends in electric space heating.

Regional Peak Forecast

Methodology

Within each region the peak is composed of the demand for electricity at the distribution level (i.e., residential and commercial/light industrial loads), transmission customer loads (i.e. large industrial loads) and any inter-utility sales plus losses.

BC Hydro prepares regional distribution peak forecasts for ten distribution areas in British Columbia: Vancouver Island North/Central, Vancouver Island South, South Interior, North Region, and six Lower Mainland areas. The forecasts are driven by three primary factors: 1) economic forecasts, 2) electric space heating forecasts, and 3) short-term forecasts of account additions. Econometric models are used to translate these driving variables into distribution peak forecasts for each region.

Transmission customer load forecasts are developed individually for BC Hydro's approximately 120 transmission voltage customers. These are based on knowledge of their markets, production plans, production scheduling, and technology.

Total peak forecasts for each region are obtained by summing the distribution and transmission peak forecasts. Coincidence factors are applied to both prior to summation to account for load diversity (i.e., differences in the timing of distribution substation and transmission customer peaks relative to the aggregate regional peak). These coincidence factors are based on analyses of historical data.

Inter-utility capacity sales and firm capacity exports are included in the regional peak forecasts at the point of sale.

Included in the regional peak forecast are distribution losses because the forecasts are prepared at the substation level and represent the sum of regional substation peaks. Transmission losses are included in the integrated system peak forecast only.

The BC Hydro integrated system peak forecast is the coincident sum of the four regional peak forecasts, plus a forecast of the total transmission losses at the time of the system peak. The assumed inter-regional coincidence factors and transmission loss factors are based on historical data.

Regional Economic Forecast

At the distribution level, electricity demand is closely linked to the health of the local economy. As such, regional economic outlooks are one of the primary inputs into regional peak demand forecasts. BC Hydro obtains economic forecasts from BC Stats,

external consultants, and the Greater Vancouver Regional District.

The BC economy is dependent on several factors. In recent years, the economic conditions in Asia have had an impact in all regions in BC through declined international immigration and diminished demand for many of the commodities of the BC resource economy. Further demand reductions are anticipated as a result of the slow down in the US economy. In addition, supply constraints in many sectors (i.e., declining annual allowable cut, salmon conservation, limited opportunities for mining exploration) have exacerbated some of these economic problems.

For many regions in the province, 1998/99 appeared to be the "trough" of the current economic cycle. The current economic outlook for BC assumes a continued gradual improvement over the next few years. This improvement will be supported by some upturn in commodity markets; continued slow growth in Asia; and, a modest upswing in population growth resulting from the cooling of Alberta and Ontario economies. Regional and sectoral swings in the economy, consistent with commodity cycles, will however continue.

Figure 7.1 outlines the differences in population growth in different areas of the province. Population is expected to grow fastest in the suburban areas of the Lower Mainland particularly the Fraser Valley and Coastal areas. Differences in regional economic growth rates reflect demographic characteristics, migration and retirement settlement preferences, land availability, relative housing costs, and industry outlooks. Several regions will be affected by reductions in resource supply, which will be partially offset by growth in the service, tourism and technology sectors.

The following sections outline the economic trends and issues affecting the regional peak forecast in each of the four planning regions.

Lower Mainland

The lower mainland region encompasses the Greater Vancouver and Fraser Valley areas. It is divided up into six planning areas to account for differences in growth.

Interprovincial and international migration has a significant impact on the Lower Mainland region, particularly in Greater Vancouver. In the early 90's, the region benefited from extremely high levels of net migration from Asia and from other provinces in Canada. In the late 90's however, the situation was reversed. A downturn in the financial climate of Pacific Rim countries and a decline in the BC economy relative to other provinces in Canada has resulted in less people coming to the Lower Mainland.

The forecast for the Lower Mainland reflects the continued adoption of the Growth Management Strategy from the Greater Vancouver Regional District's (GVRD's) Livable Region Strategic Plan. The plan is used as a guideline for the pattern of growth in the region and is aimed at containing "urban sprawl" by planning development at a regional level.

Throughout the 90's, the Greater Vancouver area experienced considerable out-migration to other areas, the Fraser Valley and Coastal regions in particular. As part of the growth management strategy, the long-term growth forecast for the Fraser Valley has been reduced. This is a result of focusing growth into a compact metropolitan area bounded by Vancouver, Burnaby, Coquitlam, and Surrey. The plan reinforces an existing trend toward denser housing, with multiple housing units (apartments and townhouses) outpacing single detached housing over the forecast period (Figure 7.2).

Aside from the importance of population growth as an economic driver, the region's economic diversity is a key factor in the forecast. The Lower Mainland's economic diversity in knowledge based, high technology and tourism sectors has sheltered

it from much of the down turn experienced in the resource dependent regions of the Province. In the Fraser Valley, the agriculture and forest sectors are expected to experience relative stability over the next decade. All these factors are anticipated to contribute to modest growth for the Lower Mainland region throughout the forecast period.

Vancouver Island

The Vancouver Island region is comprised of two planning areas, Vancouver Island South and Vancouver Island North/Central. These are forecast separately due to the differences in each area's characteristics and economic drivers.

Vancouver Island South

Vancouver Island South has a varied economic base that includes inputs from public administration, tourism and resource sectors while supporting a large retirement community.

The public sector is a major component of the area's economy due to the presence of the Provincial Legislature and a large contingent of Federal civil servants. It is anticipated that fiscal restraint resulting from efforts to reduce the Provincial debt will limit growth in the sector.

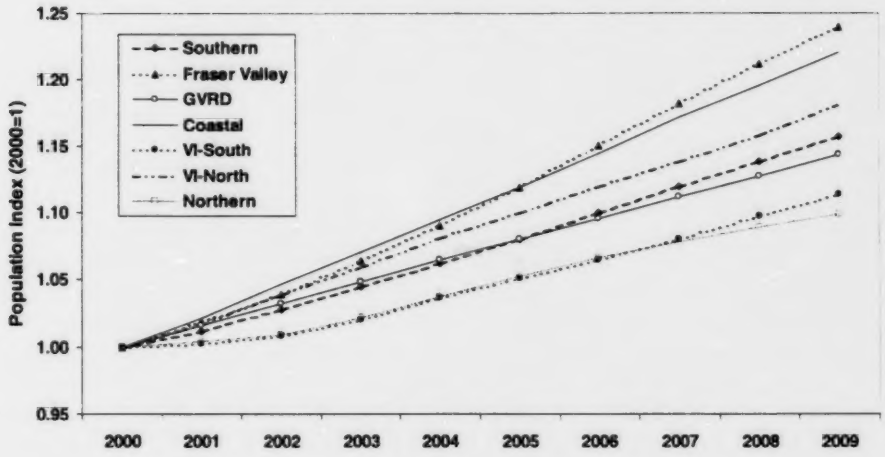
Tourism is also a large contributor to the economy. The growth in this sector has however, declined in recent years and it is expected that the sector will continue to experience some difficulty throughout the forecast period.

Although the forest sector plays a relatively small role in South Vancouver Island as a whole, it is a major contributor to the economy of the area around Duncan. After several years of declining activity, the forest sector is expected to be influenced positively by recovering Asian markets and stronger pulp prices. Expansion within the sector will however, be constrained due in part to supply limitations, restrictions on B.C. lumber exports to the U.S. and international competition in pulp and paper.

Like the Lower Mainland, Vancouver Island South has witnessed a marked decline in interprovincial migration compared to the 1993 - 1995 period. Overall, it is expected that population growth will remain low in the medium term.

FIGURE 7.1

2000 Regional Population Growth Forecast

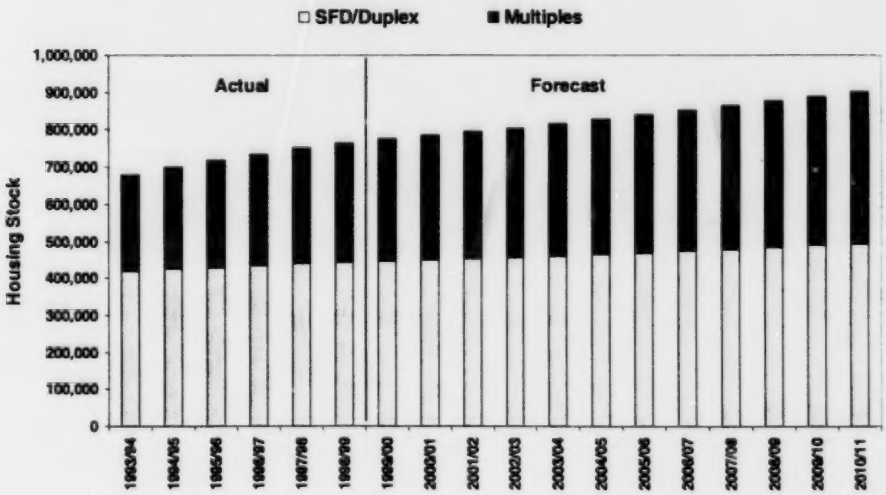


Notes:

1. Coastal includes Squamish, Whistler, Sunshine Coast and Powell River.

FIGURE 7.2

2000 Lower Mainland Housing Stock & Forecast



Vancouver Island North/Central

Economic growth in the Vancouver Island North/Central area depends heavily on the performance of the resource based commodities. The forestry sector is the largest single contributor to the region's economy; however, fishing and mining also play significant roles in many communities. Recent increases in pulp prices are providing some stimulus for investment despite some sharp declines in lumber prices. Recovering Asian markets will have a positive influence on forest product exports. Declines in U.S. housing starts are anticipated to have a tempering effect.

The downturn in the Asian economy continues to plague BC's coal industry and uncertainty has postponed the redevelopment of the Cumberland Coal mine at Tsable River.

Commercial fishing has been adversely impacted in recent years due to decreased stocks, a focus on conservation, and a Federal Government strategy to reduce the size of the west-coast fishing fleet. It is expected that the industry will continue to experience further rationalization over the forecast period. The outlook for the aquaculture sector is more promising. The farming of fish and shell-fish are a large and growing portion of BC's exports, which is expected to stimulate economic growth in many communities affected by the collapse of the commercial salmon fishery.

Overall, the region is expected to be entering a period of slow economic growth spurred by some strengthening in key resource markets and a gradual increase in net interprovincial migration.

South Interior

BC's South Interior encompasses three distinct areas, East Kootenay, Thompson Okanagan and West Kootenay. West Kootenay is not explicitly considered in this forecast because it is not serviced by BC Hydro.

While the South Interior is resource dependent, it also benefits from some economic diversity in tourism. The bulk of forestry output in the region is in lumber production destined for the U.S., rather than pulp and paper and other international markets. As a result, the region will benefit slightly from a recovery in Japanese lumber exports and increases in pulp prices. Significant uncertainty for the sector exists around issues related to lumber exports and the strength of the housing market in the U.S.

The region's coal, copper, lead and zinc mines continue to be affected by the economic slowdown in Asia. The recent modest recovery in prices is having a positive, albeit slight, influence on the region's mines. Uncertainty at both the Sullivan and Highland Valley Copper mines results in limited opportunity for employment growth within the sector. A similar story exists for the coal mines in the eastern part of the region. It is expected that rising commodity prices and improving export markets will help to reduce inventories over the short term.

Tourism continues to contribute a growing share of long-term area growth fueled by a variety of ski developments, golf courses and other recreational facilities. This trend is expected to continue over the forecast period.

The forecast for the South Interior region reflects the combined effect of the uncertainty within the forestry and mining communities and the more positive outlook in the tourism and retirement centres.

Northern Region

The Northern region is rich in mineral, agricultural and forest resources resulting in an economy based primarily on resource extraction. This makes the region susceptible to swings in population,

employment and housing activity associated with the changing demand for resource products. The forecast reflects uncertainty over commodity prices, harvest capacity, salmon stocks and the transient nature of the region's workforce.

Forest products are a large and important sector in BC's Northern Region. The sector has benefited from a modest recovery of Asian markets, a strong US economy and increased certainty over timber allocations. Slow increases in demand, international competition, quotas on lumber exports to the US, possible declines in US housing starts, and market fluctuations are however, limiting factors for the industry.

The region's mining sector has experienced a similar cycle. A variety of factors from low prices, environmental regulations, uncertainties over land claims and more favorable offshore investment opportunities may limit growth in the industry. This is resulting in a low level of exploration, significant delays in new mine development, some closures and continued uncertainty for employment growth. The recovery of oil and gas prices is providing some economic stimulus in the eastern part of the region.

Coastal communities have been impacted by low salmon stocks, trends towards conservation and government restrictions on the size of the commercial fishing fleet. It is expected that the industry will see some stabilization in 2001.

Regional Electric Space Heating Forecast

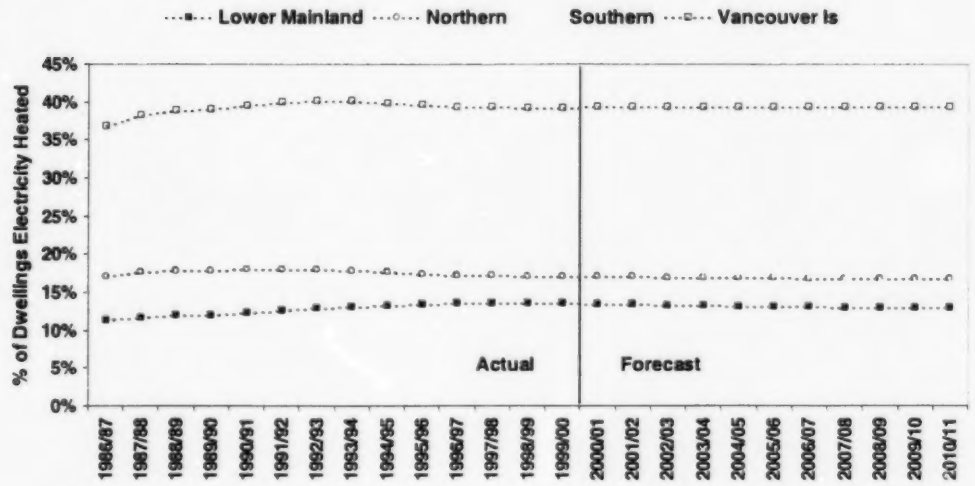
The penetration for residential electric space heating is another key input to the regional peak demand forecast. Figure 7.3 shows the historical and forecast fraction of residential accounts with electric space heating by region. The regional differences in electric space heating penetration reflect differences in the availability of natural gas and prices. Recent increases in natural gas prices will increase the penetration of electric heating in all regions of the province to some extent. These changes will occur over time because space heating is tied to the turnover of housing stock, as well as the extension of the gas distribution network.

The forecast gradual increase in electric space heating penetration in the Lower Mainland reflects the long-term trend toward densification of residential dwellings in the region, as was shown in Figure 7.2. This is driven by apartments and rowhouses, which have much higher saturation rates of electric space heating than single detached homes.

The trend in electric space heating on Vancouver Island demonstrates the increased availability of natural gas following the completion of the Vancouver Island natural gas pipeline in 1991. Penetration of gas heating will be constrained by gas/electricity price differentials, market acceptance of conversions, and the high cost of extending the gas distribution network.

FIGURE 7.3

2000/01 Electric Space Heating Forecast by Region



Regional Distribution Peak Forecast

Figure 7.4 compares forecast 10-year growth rates for the ten distribution peak forecasting areas. The highest growth areas are the suburbs of the Lower Mainland, particularly Coquitlam/Maple Ridge and Fraser Valley West.

Regional Transmission Customer Peak Forecast

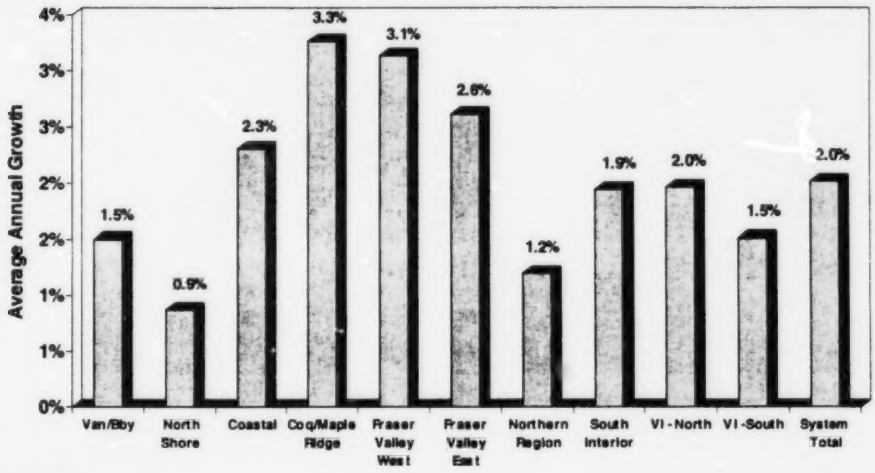
Figure 7.5 compares forecast transmission customer peak growth to forecast distribution peak growth by region. In all regions except the North, transmission customer peak is forecast to grow more slowly than distribution peak. This reflects the expectation that most of the new mining and forest products facilities will be in the North. Heavy industry growth will be slow in other regions due to a variety of resource supply and land-use constraints. On a system total basis, distribution peak is forecast to grow faster than transmission customer peak. This reflects the maturation of primary industry in BC and the shift of the provincial economy toward service sector activity.

Regional Total Peak Forecasts and Integrated System Peak Forecast

Peak forecasts for the Lower Mainland, Vancouver Island, South Interior, and Northern Regions, and for the integrated system are given in Table 7.1.

FIGURE 7.4

Distribution Peak Forecast
Average Annual MVA Growth (2000/01-2010/11)



Notes:

1. Coastal includes Squamish, Whistler, Sunshine Coast and Powell River.
2. Fraser Valley West includes Richmond, Delta, Surrey and Langley.
3. VI south includes Greater Victoria, Duncan and the Gulf Islands.

FIGURE 7.5

Distribution vs Transmission Peak Forecast
Average Annual MVA Growth (2000/01-2010/11)

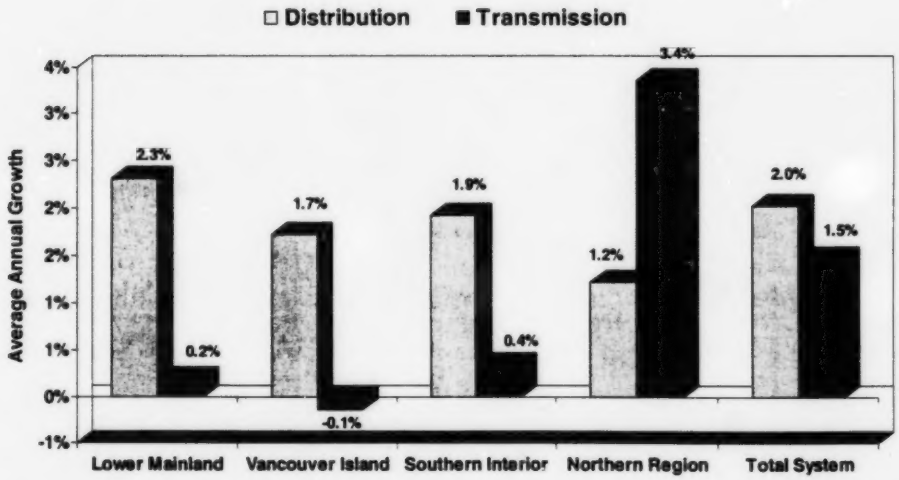


TABLE 7.1
Integrated System Peak Forecast by Region
(MW)

	Fiscal Year	Lower Mainland	Vancouver Island	South Interior	Northern Region	Transmission Losses >60 kV	Integrated System Total
Actual	1996/97	4,020	1,878	966	1,276	572	8,231
	1997/98	4,023	1,661	1,094	1,268	619	8,216
	1998/99	4,155	1,971	995	1,354	652	8,750
	1999/00	4,049	1,800	1,028	1,270	625	8,409
Forecast	2000/01	4,235	2,029	1,062	1,346	668	8,975
	2001/02	4,320	2,052	1,086	1,352	679	9,122
	2002/03	4,404	2,077	1,106	1,375	691	9,283
	2003/04	4,493	2,103	1,122	1,386	702	9,435
	2004/05	4,578	2,137	1,114	1,413	712	9,582
	2005/06	4,679	2,158	1,128	1,451	726	9,770
	2006/07	4,780	2,189	1,141	1,541	744	10,020
	2007/08	4,872	2,220	1,166	1,559	757	10,198
	2008/09	4,976	2,253	1,184	1,657	776	10,464
	2009/10	5,082	2,286	1,203	1,679	790	10,653
	2010/11	5,190	2,321	1,222	1,701	805	10,847
	2011/12	5,282	2,362	1,229	1,719	817	11,013
	2012/13	5,377	2,405	1,235	1,737	829	11,183
	2013/14	5,477	2,451	1,242	1,756	843	11,364
	2014/15	5,573	2,494	1,249	1,775	855	11,537
	2015/16	5,676	2,541	1,256	1,795	869	11,723
	2016/17	5,774	2,585	1,263	1,813	882	11,899
	2017/18	5,870	2,629	1,270	1,832	895	12,073
	2018/19	5,973	2,675	1,277	1,852	908	12,256
	2019/20	6,073	2,720	1,284	1,871	921	12,437
	2020/21	6,172	2,765	1,292	1,890	935	12,615
Growth Rates:							
5 yrs	/00-/05	2.5%	3.5%	1.6%	2.2%	2.6%	2.6%
11 yrs	/00-/11	2.3%	2.3%	1.6%	2.7%	2.3%	2.3%
21 yrs	/00-/21	2.0%	2.1%	1.1%	1.9%	1.9%	2.0%

Notes:

1. Regional peaks include distribution losses but not transmission losses.
2. The integrated system peak is less than the sum of the regional peaks plus transmission losses because regional peaks occur at different times.
3. Lower Mainland peak includes sales to the City of New Westminster and firm exports to Seattle City Light.
4. South Interior peak includes sales to West Kootenay Power.
5. Northern peak includes integrated system only.

SECTION 8 - FORECAST PROCESS AND METHODOLOGY

Load Forecast Process

The load forecast process consists of four major steps:

- the initiation of major inputs;
- the development of a reference forecast;
- the development of a most probable forecast; and
- a management review and approval of the probable forecast.

The process generates a range of demand forecasts to reflect the outcome of different economic outlooks and uncertainties; explores implications on resources, system, and financial requirements; and selects a probable scenario for planning purposes. Fig. 8.1 summarizes this process.

(a) Initiation of Major Inputs

The gathering of information for updating the load forecast is an ongoing process. The following inputs form the base for preparing the 1998 long term load forecast:

(i) Information for the preparation of the population forecast is obtained mainly from the B.C. Ministry of Finance and Corporate Relations.

(ii) Input provided by outside consultants including:

- a provincial economic forecast;
- a BC Hydro Regional Economic Outlook;
- an outlook for the forest products industry (wood and pulp and paper);
- an analysis of BC's metallic minerals sector;
- a report on BC's coal mining industry;
- an analysis of world demand for copper;
- a background paper on the chemical industry;
- a study on world crude oil and North American natural gas prices.

(iii) A short term BC Economic Forecast.

(iv) A short term customer forecast prepared by each BC Hydro district office, including projections of residential and general customer additions for the next four years.

(v) Information on large industrial customers' short term plans obtained from BC Hydro's Marketing and Sales Key Account Management. The latter department is in constant contact with the utility's large industrial and commercial (transmission voltage) customers. Information is obtained on an individual customer basis, and forms the basis of the short term industrial transmission forecast.

(b) Development of a Reference Forecast

The forecast is developed using a "top down/end use" approach, and is the product of two variables: stock of electricity uses, and electricity intensity per unit of stock.

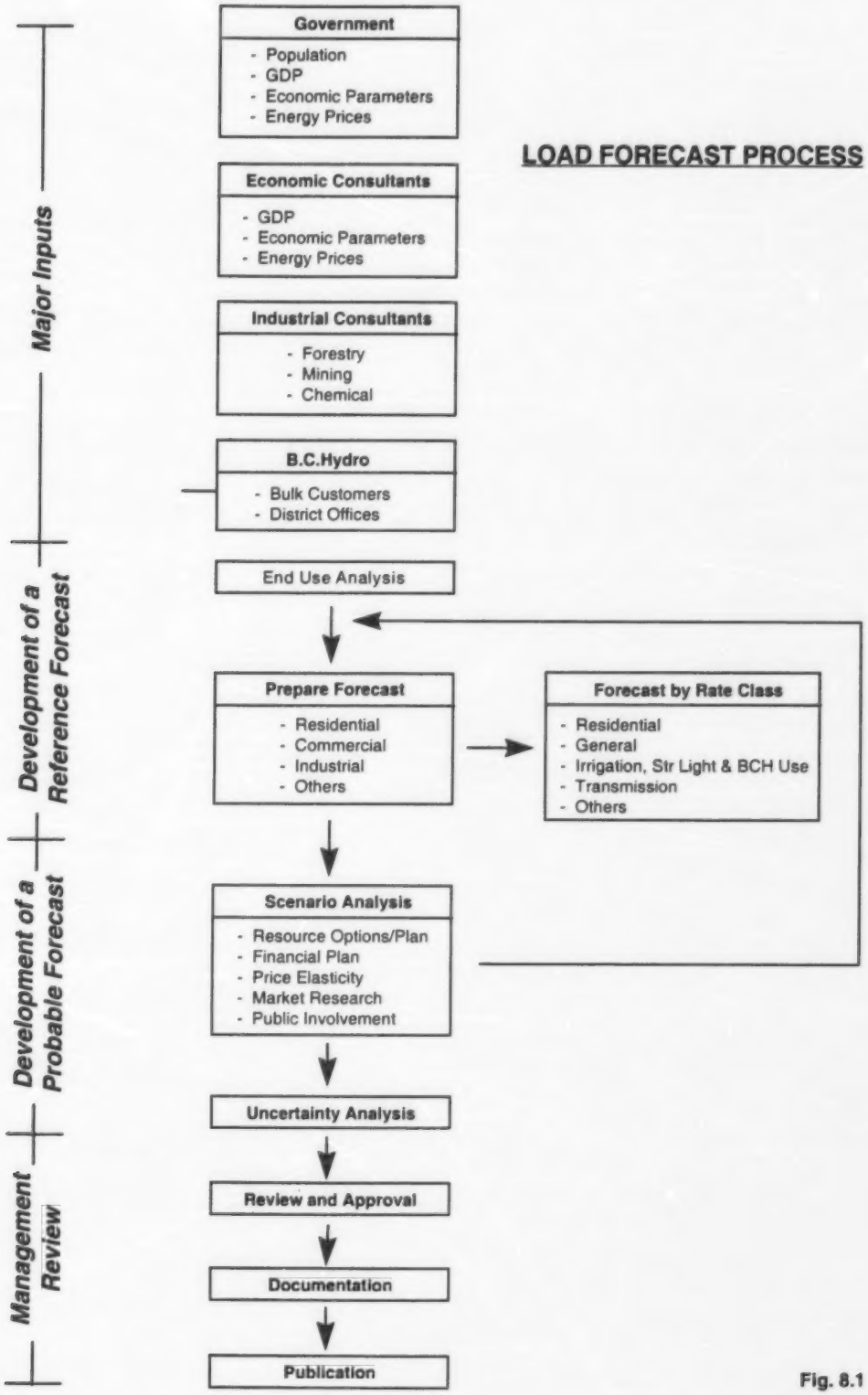

LOAD FORECAST PROCESS
Major Inputs
Development of a Reference Forecast
Development of a Probable Forecast
Management Review
Government
- Population
- GDP
- Economic Parameters
- Energy Prices
Economic Consultants
- GDP
- Economic Parameters
- Energy Prices
Industrial Consultants
- Forestry
- Mining
- Chemical
B.C.Hydro
- Bulk Customers
- District Offices
End Use Analysis
Prepare Forecast
- Residential
- Commercial
- Industrial
- Others
Forecast by Rate Class
- Residential
- General
- Irrigation, Str Light & BCH Use
- Transmission
- Others
Scenario Analysis
- Resource Options/Plan
- Financial Plan
- Price Elasticity
- Market Research
- Public Involvement
Uncertainty Analysis
Review and Approval
Documentation
Publication

Fig. 8.1

The top down aspect of the approach entails the use of the population and economic forecasts and sectoral outlooks to project "stock" in the form of household formation, commercial activity, and industrial production which generate the need for electricity.

The end use focus consists of analysis of present electricity use patterns, and of potential changes in those patterns in the future to project "electricity intensity per unit of stock" in the form of electricity consumption per housing unit, electricity input per unit of commercial floor space, and per unit of industrial production.

(c) **Development of a Probable Forecast**

The Probable Forecast includes the development of short and long term projections of sales, energy, and peak requirements. Regional details by rate are developed for 11 years. Also, monthly details for the next fiscal year are prepared for use in revenue forecasts.

The Probable Forecast is developed by employing an iterative process to examine the implications of the projected load growth on Hydro's supply, demand, and financial planning functions:

- A Preliminary Resource Plan is developed by the Resource Planning group to examine resource acquisition and supply and demand options required to meet the projected load.

- A Probable Electricity Rate is developed by the Financial Services group by evaluating implications of the load forecast and resource plan on revenue and financial requirements.

- The effects of energy price changes are examined by first establishing the scope customers have for changing electricity use. Short and long term electricity elasticity factors are then applied to the three customer groups (Residential, Commercial, and Industrial) to evaluate the impact of electricity price changes on the forecast.

- The Probable Demand Forecast incorporates the savings to date resulting from demand side management programs, with projected future demand based on the assumption that such programs are suspended and would have only a residual effect on demand.

- The Probable Load Forecast reflects the reduction in the demand forecast expected from continuation of existing and planned demand side management programs. The Probable Load Forecast therefore represents a forecast of the electricity usage that will be measured at the customer meter.

  Projected savings from natural conservation are included in both forecasts.

(d) **Management Review and Approval of the Probable Forecast**

A Sensitivity Analysis is conducted to reflect the overall uncertainties implicit in the load forecast. The Probable Forecast and results of the Sensitivity Analysis are submitted to internal and external user groups for review. Senior management's review and approval of the Probable Forecast ensures a consistent basis for the development of resource, system, and financial plans to meet the most likely range of electricity demand requirements.

Load Forecast Methodology

(a) **Residential Sales**

The residential forecast is developed using two models: the population model; and the residential model. Starting with demographic projections of fertility, mortality, and migration, an age specific population forecast is developed using the cohort model for each of BC Hydro's operating divisions (regions). The provincial level results are compared and

made to conform with the Ministry of Finance and Corporate Relations population projection, and with the short term customer forecast prepared by each BC Hydro regional office. The detailed results become one input to the residential model.

The residential model is an end-use stock model. Beginning with an age specific regional population projection and using projections of headship rates and dwelling preferences, the model develops a regional housing stock for each year of the forecast. Based on a base year load profile for each dwelling type in each region, and on projections of usage trends for space heating, water heating, lighting, and other appliances, the model develops energy sales forecasts. Also included in the model are considerations of space heating fuel choices based on fuel prices, furnace efficiencies, and gas availability; demolitions, conversions, and retrofitting of housing stock; and penetrations and life cycles of various appliances.

REEPS, the Residential End-Use Energy Planning System, a computer model from EPRI (Electric Power Research Institute), is run in parallel with the residential model to verify the residential forecast.

A procedure also exists for developing projections of short term (three year) account additions from operating personnel in the regional offices. Starting at the district level, residential heating and non-heating (plus general under 35 kW and general 35 kW and over) category customers are added to the regional level. Regional numbers are compared to the results based on the long-term methodology, and, via consultations between Load Forecast and divisional staff, to determine short term customer numbers. The customer numbers become the basis for providing regional energy projections for distribution planning purposes.

Historical energy data essential to the forecast analysis are maintained. They are used in part for the weather normalization procedure which provides adjusted use data for the base year load profile.

(b) **Commercial Sales Methodology**

The commercial forecast for the total BC Hydro system is developed using the COMMEND (Commercial end-use planning system) model. COMMEND is an end use energy forecasting model developed by EPRI. It is used to prepare the forecast of the building-related portion of the commercial sector sales. Non-building related sales, such as transportation, communication, utilities, unclassified non-residential and small residential loads (i.e. common areas in mobile home parks), were prepared outside the model using spreadsheet analyses.

The model uses an end-use framework to provide estimates of energy use by building type and end-use. The 13 building types defined in the model are large office, small office, non-food retail, food retail, restaurant, wholesale/warehouse, hotels, hospitals, nursing homes, schools, college & university, apartments (common areas) and miscellaneous. Within each building type, energy use for each of the ten end-uses is computed. The end uses are space heating, space cooling, ventilation, domestic water heating, refrigeration, cooking, indoor lighting, outdoor lighting, office equipment and miscellaneous.

COMMEND defines energy use as the product of three factors. These are: the amount of floorspace (floorstock); the share of floorspace using electricity, gas or oil (fuel share); and the energy use of each equipment type that is used in the buildings (Energy Use Indices, EUI). Floorspace provides a fairly accurate measurement of energy using equipment and activities in the commercial sector and is a key input to the model. The forecast of floorspace by building type was developed using population and sectoral GDP forecasts as drivers to update the floorspace forecasting equations included in the model for each building type.

BC Hydro customers are coded by the Standard Industrial Classification (SIC), allowing load data to be analyzed and projected in a manner consistent with the categorization of the sectoral economic drivers.

The fuel share forecast for electricity reflects the tendency of decision makers to choose the cheaper fuel alternatives when real electricity prices increase. EUI is a measure of annual energy usage per square foot of floorspace in buildings that are served by an end use. It embodies both efficiency and utilization concepts and where applicable is provided for the ten end-uses in 13 building types and by three fuel types.

The commercial forecast by subsectors is prepared by mapping the forecast of energy sales by building types produced by COMMEND onto one of the following subsectors to generate a forecast for each subsector:

- Transportation, Communications and Other Utilities
- Wholesale and Retail Trade
- Finance, Insurance and Real Estate
- Community, Business and Personal Services
- Public Administration
- Unclassified

(c) **Industrial Sales**

The industrial forecast is based on detailed analysis of each major industrial subsector. For the areas of greatest significance, which are forest products, mining, and the chemical industry, world market perspectives obtained from consultants are used as the basis of the longer term forecasts. Production levels are analyzed in relation to provincial sectoral GDP forecasts where appropriate. Patterns in energy intensity are considered in relation to technological change. Specific customer information is obtained and used to ensure consistency between the short term projections and the macro industry outlook.

The forecast is prepared on a customer specific basis for the large transmission rate accounts.

(d) **Total Gross Generation Requirements**

Total gross generation requirements are obtained by adding losses to sales estimates. Losses are based on historical differences between gross generation and sales data.

Energy losses are calculated in two steps. First, distribution losses are calculated as 4.0% of distribution sales. Distribution sales include all customers not served directly at transmission voltage (60 kV or above). Second, transmission losses are calculated as 8.1% of the total of distribution sales, distribution losses, and transmission sales. The overall result is that total losses are about 11% of total sales.

(e) **Capacity Requirements**

Peak demand is forecast separately from energy demand using a "bottom up" approach: distribution and transmission customer peaks are aggregated within each region, and regional peaks are aggregated to the integrated system peak.

As explained in Section 7, distribution peak forecasts are prepared for ten areas using econometric models that relate peak growth to forecasts of regional economic indicators. Transmission voltage customers' peak demands are forecast individually based on outlooks for their markets, production technologies, and scheduling. The distribution and transmission customer peak forecasts are aggregated to four regional peak forecasts, with differences in the timing of distribution and transmission customer peaks accounted for by applying coincidence factors. The regional peak forecasts also

include inter-utility capacity sales (e.g. to West Kootenay Power and the City of New Westminster) and firm capacity exports (e.g. to Seattle City Light). The regional peak forecasts are adjusted for demand side management and rate impacts on peak demand.

The integrated system peak forecast is the coincident sum of the four regional peak forecasts, plus forecast total transmission losses at system peak time. The assumed inter-regional coincidence factors and peak loss factor are based on historical data.

SECTION 9 - INTERRUPTIBLE MARKETING PROGRAMS (E+) AND POWER SMART

INTERRUPTIBLE MARKETING PROGRAMS (E+)

The intent of the E+ programs was to sell secondary energy at reduced rates for space and water heating purposes with the proviso that the service would be interruptible. Secondary energy is defined as the energy often available in normal or above average water years on BC Hydro's system. Customers can be interrupted in years when adequate secondary energy is not available, or for certain peak demand critical situations.

Surplus or additional energy is no longer available, so although sales are continuing through existing interruptible accounts, no new interruptible accounts will be opened. Sales to all existing interruptible accounts are expected to remain at their 1990/91 levels of 253 GW.h.

TREATMENT OF POWER SMART PROGRAMS IN THE LOAD FORECAST

Power Smart is BC Hydro's name for demand side management (DSM) programs. These programs refer to utility activities designed to reduce the utility's load. The reduction results from increased efficiency of energy use by the consumer, with this increased efficiency having been induced by the utility.

The method used for incorporating DSM into the Load Forecast has been modified to reflect the maturing nature of the programs which have been in operation since 1989. DSM programs are separated into two components: savings achieved to date, and future savings from continuing operation of the initiatives to date.

To acknowledge the long run impact of DSM programs, two Probable Forecasts were produced: Probable Load and Probable Demand.

- Implicit in the end-use load profile of both forecasts are "historical" savings to date resulting from DSM programs in operation since 1989.

- For forecasting purposes, projected savings from natural conservation are included in both forecasts.

  - The Probable Load Forecast represents the projected electricity requirements should BC Hydro continue its current DSM programs.

  - The Probable Demand Forecast assumes that DSM programs are suspended, and would have only a residual effect on future end use load profiles.

The Probable Demand Forecast represents a base case.

Forecast electricity requirements in this document reflect the Probable Load Forecast.

DSM programs have been in operation for more than five years, so their impact as well as behavioral changes and natural conservation impacts are included in the end-use load profiles for both forecasts.

For forecasting purposes, the Probable Demand forecast recognizes that: DSM programs already in place will have some lasting impact on consumption patterns; projections of changes in usage patterns are based on observations of changes that have already occurred; and, changes in usage

patterns that have occurred already include the impact of DSM programs in operation.

The difference between the Probable Demand and the Probable Load Forecast is the projected savings from DSM programs for that year. DSM savings from future programs are treated as resources to allow evaluation of the costs and benefits of using demand side options in the Resource Plan.

BC Hydro is making efforts to quantify various behavioural aspects of electricity consumption, namely customer responses to DSM programs versus responses to electricity price changes, and conservation from DSM versus savings induced by other market and customer initiatives. The methodology for incorporating Power Smart behavioral effects and natural conservation into the demand forecast will be refined as more and improved information becomes available.

SECTION 10 - FORECAST UNCERTAINTY & SENSITIVITY ANALYSIS

Methodology Used To Produce The Uncertainty Band

There are two major components of uncertainty in the long-term load forecast:

- uncertainty in the future levels of major causal factors and their effect on future electricity consumption levels; and
- uncertainty about how the relationships between the major causal factors and electricity consumption may change over time.

To reflect the overall uncertainties implicit in the load forecast, five major causal factors were used to analyze the sensitivity of the 1998 probable forecast: the long-term economic growth rate (reflected by GDP); the electricity rate; the effective energy reduction achieved by demand side management (DSM) programs; the response to electricity price changes (price elasticity); and, the electricity intensity.

Probability distributions were assigned to each of the causal factors. Three values (low, probable, and high) were established to reflect possible future levels of each of the five causal factors, with a probability assigned to each.

An uncertainty model employing Monte Carlo simulation methods was used to quantify and combine the probability distributions, reflecting the relationships between the five causal factors and electricity consumption. A probability distribution was thus obtained which showed the likelihood of various load levels resulting from the combined effect of the five factors.

The low scenario:

There is a 10% chance the outcome will be below this value.

The probable scenario:

It is most likely that the outcome will equal this value.

The high scenario:

There is a 10% chance that the outcome will exceed this value.

Table 10-1 below summarizes the results of the uncertainty analysis on the energy and peak forecast. Figure 10.1 and 10.2 outlines the trends resulting from these uncertainties.

TABLE 10-1
FORECAST SCENARIO

Fiscal Year	LOW LOAD		PROBABLE LOAD		HIGH LOAD	
	Gross Requirements (GW.h)	Integrated System Peak (MW)	Gross Requirements (GW.h)	Integrated System Peak (MW)	Gross Requirements (GW.h)	Integrated System Peak (MW)
1999/00	51,691	8,646	51,691	8,646	51,691	8,646
2010/11	59,643	10,639	62,309	11,115	64,909	11,579
2020/21	65,876	12,010	70,825	12,913	76,268	13,906
Growth over 21 yrs:	14,187	3,364	19,134	4,267	24,577	5,260
Average Annual Growth Rate (21 yrs): 1999/00 - 2020/21	1.2%	1.6%	1.5%	1.9%	1.9%	2.3%

FIGURE 10-1

Total Gross Requirements

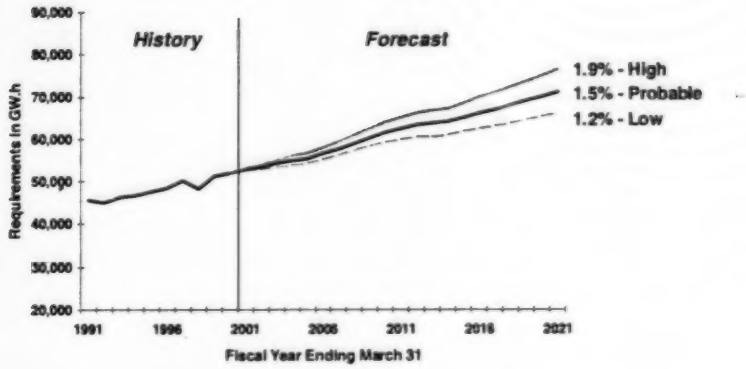
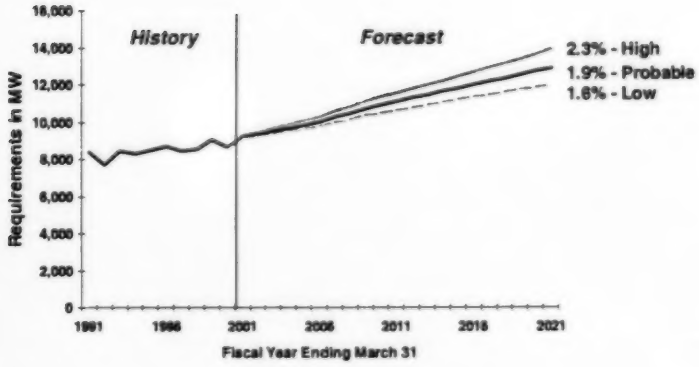


FIGURE 10-2

Peak Demand Forecast



Uncertainty Assumptions

For each of the five major causal factors, a probability distribution defined by low, probable, and high scenarios was assigned.

(a) **Long-Term Economic Growth (GDP)**

The long-term growth scenarios used were based on average annual GDP increases of 2.1% with a standard deviation of 0.5%.

(b) **Electricity Rates**

The probable scenario assumes that electricity prices in B.C. will decrease slightly in real terms (i.e. net of inflation) between 1999/00 and 2004/05 and then show a small increase between 2005/06 and 2009/10. The low and high scenarios assume that annual electricity rate changes will be within a 2.5% band of the probable rate changes.

(c) **Effective Energy Reduction of Demand Side Management (DSM) Programs**

The annual low, probable, and high reductions from DSM used were 50%, 100%, and 150%, respectively, of the expected reductions.

(d) **Response to Electricity Price Changes (Elasticity)**

The elasticity of electricity demand measures the change in the consumption of electricity in response to changes in variables influencing such demand. However, estimates of elasticity are subject to considerable uncertainty. The range of values of price elasticities for the various sectors are estimated to be as shown in Table 10-2. The overall price elasticity of peak demand is assumed to be 75% of the energy demand elasticity, reflecting a reduced price sensitivity of demand during very cold weather.

(e) **Electricity Intensity**

Changes in overall electricity intensity are assumed to be within a 0.2% band of the annual change in electricity intensity for that year.

Table 10-2
OWN PRICE ELASTICITIES - ENERGY DEMAND

	RESIDENTIAL		COMMERCIAL		INDUSTRIAL	
	Short Run	Long Run	Short Run	Long Run	Short Run	Long Run
Selected Range	0.17 to 0.35	0.45 to 0.80	0.15 to 0.40	0.49 to 0.83	0.05 to 0.13	0.20 to 0.40
Selected for Probable Forecast	0.20	0.65	0.15	0.65	0.05	0.35

Temperature Sensitivity Of Peak Demand

The forecasts and uncertainty bands described in Table 10-2 assume normal weather. They do not include the effect of colder or warmer than normal (30-year average) temperatures. The temperature sensitivity of peak demand can be quantified by correlating historical peaks with temperatures, and adjusting for customer growth. The analysis indicates that for each degree that the minimum daily average temperature at Vancouver International Airport drops below normal (-6.2°C), 80 MW will be added to the 1999/00 integrated system peak. Under the most extreme cold temperature conditions (-14.5°C daily average at Vancouver, the 50-year minimum), the system peak could be increased by as much as 8%. The Vancouver Island peak is more sensitive to cold temperatures than the system peak because of the high penetration rate of electric space heating on Vancouver Island. Extreme cold temperature conditions could increase the Vancouver Island peak by as much as 12%.

Analysis of the historical distribution of temperatures and the effects of customer growth indicates that there is a 95% chance that cold temperatures will add less than 600 MW to the 2000/01 system peak, and less than 700 MW to the 2005/2006 system peak.

GLOSSARY

Consumer Price Index (CPI)	An inflation index calculated by comparing the price of a typical bundle of goods in the year in question to the price of the same goods in a set reference year.
Cogeneration	The sequential production of electricity and useful thermal energy or shaft power from the same fuel source.
Demand-Side Management	The influencing of energy demand to achieve socially economic efficiency improvements in the end use of electricity, and to shift electricity demand to reduce utility capacity costs.
Region	A geographical sub-division of the BC Hydro service area. Four regions exist: Lower Mainland, Vancouver Island, South Interior, and the Northern Region.
Distribution voltage customer	A BC Hydro customer who receives electricity via distribution lines that operate at relatively low voltage (34 kV and less).
Diversity	That quality or characteristic by which individual maximum demands occur at different times. Diversity may be examined on an hourly, daily, monthly, or yearly basis.
Econometric modelling	The use of statistical techniques, typically regression analysis of time-series and/or cross-sectional data, to detect statistically verifiable relationships, coherent with economic theory, between an explained variable (e.g. electricity consumption) and explanatory variables (e.g. industry output, prices of alternative energy inputs, and GDP).
Elasticity	The proportionate change in a dependent variable, (e.g. electricity consumption, divided by the proportionate change in a specified independent variable; electricity price). A dependent variable is highly elastic with respect to a given independent variable if the calculated elasticity is much greater than one. The dependent variable is inelastic if the elasticity is less than unity.
End-use model	A model used to analyze and forecast energy demand, which focuses on the end-uses or services provided by energy. Typical end-uses are lighting, process heat, and motor drive. For a given industry, the model estimates

	the influence of prices and technological change on the evolution of the secondary energy inputs required to satisfy the industry's end-uses over time.
Energy	The amount of electricity delivered or consumed over a certain time period, measured in multiples of watt hours. A 100 watt bulb consumes 200 watt hours in 2 hours. A typical BC Hydro residential account consumes about 10 000 kW.h (10 million watt hours) annually.
Gross Domestic Product (GDP)	A measure of the total flow of goods and services produced by the economy over a specified time period, normally a year or quarter. It is obtained by valuing outputs of goods and services at market prices (alternatively at factor cost), and then aggregating.
Gigawatt hour (GW.h)	A measure of electrical energy, equivalent to one million kilowatt hours.
Integrated system	That portion of the BC Hydro system which is connected as one whole. Non-integrated facilities refer to generating facilities which are not connected to the system, located in remote areas of the province.
kilowatt-hour (kW.h)	A measure of electrical energy, equivalent to the energy consumed by a 100 watt bulb in 10 hours.
Load	The total amount of electrical power demanded by the utility's customers at any given time, typically measured in megawatts (MW).
Megawatt (MW)	A unit used to measure the capacity or potential to generate or consume electricity. One MW equals one million watts.
Monte Carlo method	A technique for estimating probabilities involving the construction of a model and the simulation of the outcome of an activity a large number of times. Random sampling techniques are used to generate a range of outcomes. Probabilities are estimated from an analysis of this range of outcomes.
Natural conservation	The increase in energy efficiency that would occur in the absence of any utility-induced DSM program, all other things being equal.
Normalization	The correction of actual customer sales and peak demand for unusually warm or cold weather.

Price elasticity of demand	The percentage change in quantity demanded, divided by the percentage change in price which caused the change in quantity demanded.
Real price increases	Increases that have been adjusted for changes in prices of all goods. The nominal price of an item may rise by 10% over a year, but inflation (and assumed wages) may have risen by 7% over the same time period. Therefore the effective price increase faced by the consumer is 3%. It is necessary to deflate current prices by an appropriate inflation index (the CPI in Canada) to convert money values to constant prices or real terms.
System peak demand	The greatest combined demand of all BC Hydro customers faced by the generation system during a given fiscal year.
Transmission voltage customer	A BC Hydro customer which is supplied its electricity via high voltage transmission lines (60 kV or above).
Units of measure	The large amounts of electricity generated and consumed on a system wide basis are discussed in multiples of the basic units of watt and watt hours. Kilowatts and megawatts are used to measure power, and kilowatt hours, megawatt hours, and gigawatt hours are used to measure energy. The equivalences are:

1 kilowatt (kW)	=	1000 watts
1 megawatt (MW)	=	1000 kilowatts or 1 million watts
1 kilowatt hour (kW.h)	=	1000 watt hours
1 megawatt hour (MW.h)	=	1000 kilowatt hours or 1 million watt hours
1 gigawatt hour (GW.h)	=	1000 megawatt hours or 1 billion watt hours

APPENDIX

B.C. HYDRO HISTORICAL AND PROBABLE ELECTRIC SALES FORECAST BY RATE CATEGORIES
(Billed Sales, No Adjustment for Accrual)

Fiscal Year	Residential (GW.h)	General: Under 35 kW (GW.h)	General: 35 kW & Over (GW.h)	Trans. Rate (GW.h)		Irrigation (GW.h)	Street Lighting (GW.h)	BCH Own Use (GW.h)	Firm Domestic Marketing (GW.h)		Firm Export + Inter-Utility (GW.h) (a)	Total Billed Sales (GW.h)
HISTORICAL												
1989/90	11,002	2,835	9,950	13,375		58	241	68	1,041		714	39,284
1990/91	11,783	2,963	10,293	13,828		58	235	68	1,105		933	41,266
1991/92	11,606	2,906	10,385	13,506		63	222	57	740		865	40,350
1992/93	12,330	3,017	10,782	12,985	(b)	77	209	61	768		1,301	41,530
1993/94	12,439	2,958	11,065	13,385		53	196	55	823		1,063	42,037
1994/95	12,916	3,015	11,501	13,181		78	214	56	654	(c)	1,040	42,655
1995/96	13,300	3,060	11,686	14,474		73	200	57			740	43,590
1996/97	13,983	3,098	12,009	14,182		68	201	57			764	44,362
1997/98	13,802	3,313	12,163	13,004		58	208	58			777	43,383
1998/99	13,972	3,534	12,250	14,751		87	211	58			942	45,805
1999/00	14,572	3,581	12,450	14,697		65	215	59			1,052	46,691
Avg. Annual % incr. 10 years:												
89/90-99/00	2.9%	2.4%	2.3%	0.9%		1.1%	-1.1%	-1.4%			4.0%	1.7%
Forecast												
2000/01	14,694	3,640	12,791	14,904		70	218	60			1,284	47,661
2001/02	14,932	3,696	13,131	14,795		74	221	61			1,290	48,200
2002/03	15,172	3,757	13,475	14,993		76	224	61			1,152	48,910
2003/04	15,417	3,820	13,833	14,938		77	227	62			1,127	49,501
2004/05	15,647	3,882	14,218	14,730		79	230	62			1,113	49,961
2005/06	15,900	3,944	14,581	15,094		80	233	63			1,131	51,026
2006/07	16,145	4,007	14,952	15,496		81	236	63			1,168	52,148
2007/08	16,399	4,074	15,330	15,941		82	239	64			1,181	53,310
2008/09	16,655	4,139	15,705	16,388		83	242	64			1,196	54,472
2009/10	16,923	4,204	16,085	16,723		84	245	65			1,207	55,536
2010/11	17,197	4,270	16,453	16,842		86	248	65			1,222	56,383
Avg. Annual % incr. 11 years:												
99/00-10/11	1.5%	1.6%	2.6%	1.2%		2.6%	1.3%	0.9%			1.4%	1.7%

(a) "Firm Export & Inter-Utility" column includes: New Westminster, Point Roberts, Hyder, Out of Province (Alberta), Seattle City Light and WKP.

(b) Forest industry labour disruptions in 1992/93 caused reductions in Transmission Rate sales.

(c) Rate 1845 ended Dec 31/94.